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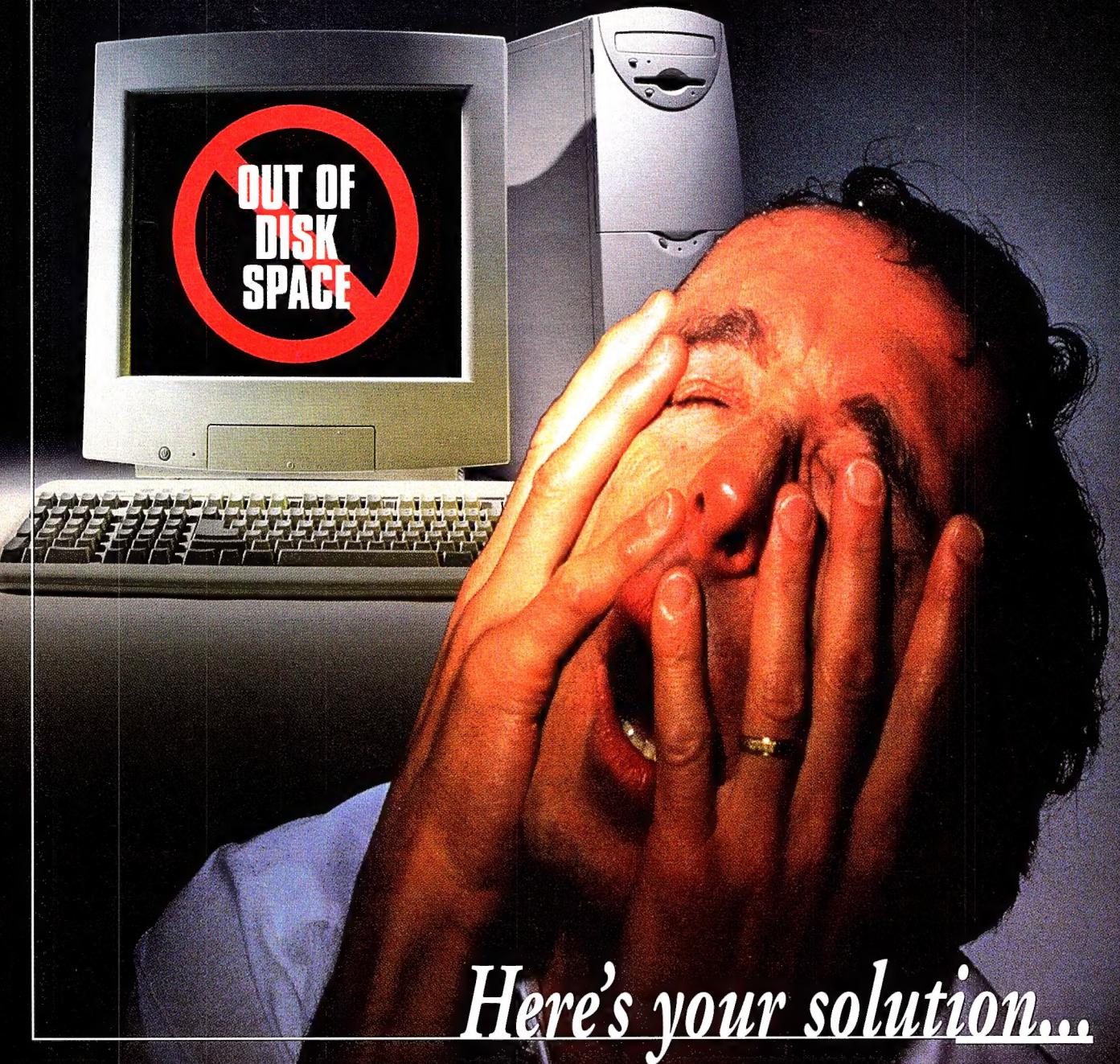
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Novell pushes the networking envelope again by releasing NetWare 5.

FEATURE

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Is your company's network ready for TCP/IP? With NetWare 5, you can easily implement a pure TCP/IP environment. You can also run the world's fastest Java server, and you can take advantage of many other new and enhanced features, such as an improved kernel and a new file storage and retrieval system.

22 Chris Stone: Novell's Senior Vice President Explains the OSA Initiative

Adding TCP/IP support to NetWare 5 is part of Novell's Open Solutions Architecture (OSA) initiative. In this interview, Chris Stone, senior vice president of Strategic Business Decisions, explains how OSA is driving Novell's efforts to support open protocols and standards.

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NetWare 5 and NetWare 4.11 will include a five-user version of Oracle8 for NetWare. This article describes the new features that are available with Oracle8 for NetWare, including Novell Directory Services (NDS) integration and the ability to create large tables and to partition these tables across multiple storage devices.

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This year's BrainShare was better than ever, with many Novell executives on hand to discuss recently announced Novell products. Find out what these executives had to say about NetWare 5 and NetWare for Small Business.

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You may have missed BrainShare '98 in Salt Lake City, Utah, but you don't have to miss the highlights of Novell's premier technical conference. You can view videos of the keynote speeches and selected technical sessions from this year's BrainShare. You can also view electronic slide presentations.

To view the videos and slide presentations, go to the *NetWare Connection* home page, and click the BrainShare '98 Highlights button. If you like what you see, you can even register online for BrainShare '98 in Africa, Australia, China, Europe, Japan, or Russia, or you can find out about BrainShare '99.

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Users seem to have a knack for getting around the roadblocks you put in their way. By following the steps outlined in this article, you can prevent users from subverting the BorderManager proxy cache when they access the Internet.

47 Online Connection: Hit the Road

Although summer has not arrived yet, planning your summer vacation now may give you something to look forward to. This article features World-Wide Web sites that you can visit to make vacation plans, from purchasing airline tickets to booking hotel reservations.

Contributors

Mickey Applebaum Linda Boyer
Jim Greene Terry L. Jeffress
Matthew Jones Stewart Nelson
Cecily Spencer Chris Stone

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Diane Fenster

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LETTERS TO THE EDITOR

Installing Windows 95

The article "Practical Networking: Creating an Automated Installation of Windows 95" (*NetWare Connection*, Mar. 1998, pp. 42-46) mentions that you can install Windows 95 on multiple workstations without any user intervention. However, after you reboot the workstations, someone must log in to the network from each workstation to continue the setup process. Also, someone must click the OK button when Windows 95 runs the help program, which displays a tip for using Windows 95.

Am I doing something wrong, or do I have to live with these things?

Rich Schiavi

Unfortunately, logging in to the network upon reboot is unavoidable. As for the help program that runs after a user logs in to the network, you cannot prevent this program from running the first time you reboot a workstation.

Daniel G. Newell

The article "Practical Networking: Creating an Automated Installation of Windows 95" includes a step that requires you to select the NWCLIENT.INF file in the SYS/C32 directory on the server and click the OK button. When I performed this step, I received the error message "Failed to copy files in INF."

Can you help me determine the problem? Instead of placing the NWCLIENT.INF file in the SYS/C32 directory, I placed this file in the SYS/WIN95/C32 directory. Also, I ran the setup process from a Windows NT workstation.

Darren Mathews

The INF installer does not work properly with Windows NT. As a result, you must use a Windows 95 workstation.

Daniel G. Newell

Installing the NDPS Client Component

The February 1998 issue of *NetWare Connection* mentions that you can use the automatic client upgrade (ACU) feature to install the Novell Distributed Print Services (NDPS) client component on multiple workstations ("Letters to the Editor," p. 4). However, I have not been able to use the ACU feature at all. After opening a support incident with Novell, I was told that this feature is intended only for upgrading previous versions of Novell client software to the latest 32-bit version and cannot be used to update client software that is already installed.

Isn't there any way around this limitation?

Bryan Keadle

Novell's IS department successfully used the ACU feature to install the NDPS client component on multiple workstations that were already running the latest 32-bit Novell client software. You can use this feature with both Windows NT and Windows 95 workstations. With a Windows 95 workstation, for example, you would complete the following steps:

1. Copy all of the files from the \PRODUCT\WIN95\IBM_ENU directory on the intraNetWare Client 2.2 for Windows 95 CD to any server directory that is accessible to the users on your company's network.
2. In the NWSETUP.INI file, add the line 1=NWNDPS to the [DeviceInstallList] section.
3. Use a container or a profile login script to run the SETUP.EXE file with the /acu option on each user's workstation. You must place the @ symbol in front of the command to run this file, and you must enter the file's universal naming convention (UNC) path.

Craig Whittle, NDPS product manager at Novell

Keeping You Informed

I must let you know how much I appreciate receiving *NetWare Connection*. The information about network printing in the February 1998 issue has helped me understand the overall printing process on an intraNetWare or NetWare network ("Technically Speaking: Network Printing Problems," pp. 40-42).

It's important to be informed of both new and existing technologies when you're a network administrator, as I am. Please keep the magazine coming. Thank you.

Shirley D. Smith

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Article Proposals. We accept articles from intraNetWare and NetWare users. Please send a proposed outline via e-mail to debi.pearson@novell.com, or mail the outline to Debi Pearson, *NetWare Connection*, P.O. Box 19007, Provo, UT 84605-9007.

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NetWare 5

Knows No Limits

Linda Boyer

In just a couple of months, Novell will unveil the shipping version of its next-generation network operating system, NetWare 5. Formerly code-named Moab, NetWare 5 has attracted a great deal of attention during the past year, mainly because of one rather conspicuous difference between NetWare 5 and previous versions of NetWare.

This conspicuous difference is support for pure TCP/IP—that is, TCP/IP without encapsulation. Although NetWare 5 maintains support for Novell's traditional IPX and SPX protocols, you now have the option of running only TCP/IP over the wire—without giving up or modifying any applications that use IPX/SPX.

NetWare 5's support for Java at the kernel level is equally revolutionary. TCP/IP and Java support in NetWare 5 lay the foundation for Novell's vision of a future characterized by open, standards-based networking.

In addition, NetWare 5 offers services that highlight NetWare's development from the file and print server it once was to the Internet and intranet application server it has become. These services include memory protection, virtual memory, and support for both one processor and multiple processors in the same kernel.

NetWare 5 also includes Novell's new file storage and retrieval system, Novell Storage Services (NSS). NSS allows you to store more data than you can now using less memory than the current file system. NSS also maintains full backward compatibility with the current file system.

Finally, NetWare 5 includes several changes that are more evolutionary than revolutionary. (For a complete list of the new and enhanced features in NetWare 5, see "What's New in NetWare 5" on p. 8 and "What's Enhanced in NetWare 5" on p. 10.) Compatibility mode, for example, supports IPX/SPX to help you migrate to NetWare 5's open protocols and standards at your own pace.

This article discusses five of the most important features that are new to NetWare 5:



- Support for TCP/IP
- Support for Java
- An improved kernel
- A new file system
- Compatibility mode

TCP/IP—GET WITH THE STANDARD

Why is Novell adding support for TCP/IP to NetWare 5? In a keynote address at COMDEX/Fall '97, Dr. Eric Schmidt, Novell's chief executive officer, shed some light on this issue. Schmidt explained that Novell has renewed its focus "to deliver the kind of technologies that people need to run their networks. That's what we're all about." The move to TCP/IP fits Novell's renewed focus perfectly.

The kind of technologies that people need to run their networks today are Internet technologies. In fact, the vast majority of companies now rely on Internet access and interoperability with networks that are connected to the Internet.

As companies connect to the Internet and to other Internet-connected networks, more of these companies want to standardize on one core protocol. The obvious choice for that protocol is TCP/IP, the protocol used on the Internet and on heterogeneous networks and intranets.

Thus, Novell is adding support for TCP/IP because companies are demanding that support. "There's little doubt," says Brian Faustyn, product manager for NetWare 5 at Novell, "that many of Novell's customers want to move to a TCP/IP-only solution." In fact, according to Mike Wilkinson, product platform manager for NetWare 5 at Novell, up to 80 percent of these customers want to move to a TCP/IP-only solution—a solution available with NetWare 5.

NCP Calls Over TCP/IP

As Novell's first pure TCP/IP network operating system, NetWare 5 uses TCP/IP—rather than IPX/SPX—as the transport mechanism for all NetWare Core Protocol (NCP) calls.



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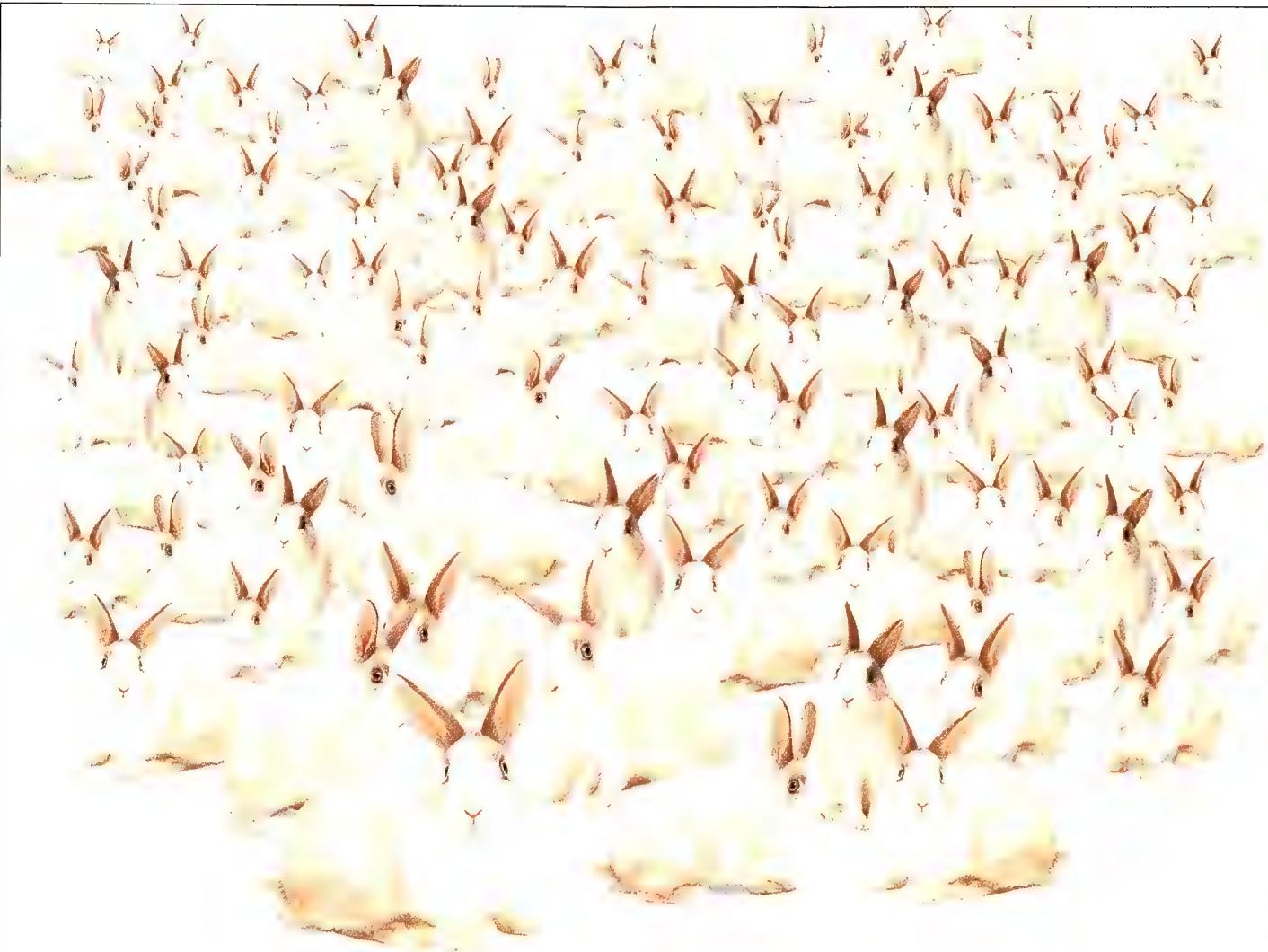
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What's New in NetWare 5

NetWare 5 includes several new features—some of which might surprise you.

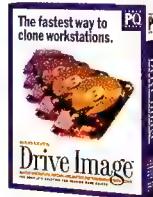
Feature	Description
TCP/IP support	NetWare 5 adds support for TCP/IP while maintaining support for IPX/SPX. As a result, you can implement a pure TCP/IP environment, or you can keep using IPX/SPX, either alone or as part of a mixed TCP/IP and IPX/SPX environment.
Java support	NetWare 5 includes a Java Virtual Machine (JVM), which is embedded in the NetWare 5 kernel. NetWare 5 also includes ConsoleOne, a Java-based server console, and several Java-based utilities, such as a GUI installation utility and a Dynamic Host Configuration Protocol (DHCP)/Domain Name System (DNS) management utility. In addition, NetWare 5 includes the Open Solutions Architecture (OSA) software developer's kit (SDK), which enables developers to write Java-based applications that run on any server with a JVM, such as a NetWare 5 server.
Improved kernel	NetWare 5 has been enhanced to provide an optimal environment for running applications. For example, the NetWare 5 kernel offers memory protection, virtual memory, application prioritization, and support for both uniprocessing and multiprocessing.
Novell Storage Services (NSS)	NetWare 5 includes NSS, Novell's new high-performance storage and retrieval system, which is backward compatible with the existing NetWare file system.
Compatibility mode	NetWare 5 offers a Compatibility Mode option, which enables you to control the rate and the degree of change on your company's network as you migrate from IPX/SPX to TCP/IP.
DHCP and DNS integration with Novell Directory Services (NDS)	NetWare 5 allows DHCP and DNS servers to store information in the NDS database. As a result, you can manage DHCP and DNS services, such as IP addresses, just as you manage the other network resources in your company's NDS tree.
Novell Distributed Print Services (NDPS)	NetWare 5 uses NDPS as its default print service. NDPS allows you to install, configure, and manage printers from a central location. NDPS also offers improved bidirectional print communications, improved job scheduling, and automated print driver installation.
New backup utility	NetWare 5 includes a new GUI backup utility that offers multiple and repetitive job scheduling. This utility, which is protocol independent, also takes full advantage of NDS, enabling you to manage the backup process from a central location.
Service Location Protocol (SLP) support	NetWare 5 includes support for SLP, an industry-standard Internet protocol. In NetWare 5, SLP discovers network services for IP clients in a pure TCP/IP environment and in a mixed IPX and IP environment.
I₂O support	NetWare 5 includes support for an emerging technology known as I ₂ O. I ₂ O is an intelligent I/O technology that vastly improves I/O throughput and overall system performance by relieving host resources (such as the processor, memory, and system bus) of interrupt-intensive I/O tasks.
Oracle8 for NetWare	NetWare 5 includes a five-user version of Oracle8 for NetWare, which has been integrated with NDS. As a result, you can use NDS to control access to your company's database. (For more information about Oracle8 for NetWare, see the related article on p. 24.)
Netscape FastTrack Server for NetWare	NetWare 5 includes Netscape FastTrack Server for NetWare, which is World-Wide Web server software based on open Internet standards. Netscape FastTrack Server for NetWare provides a cross-platform environment for creating and posting web pages and for developing and deploying web and database applications.
Zero Effort Networks (Z.E.N.works) Starter Pack	NetWare 5 includes the Z.E.N.works Starter Pack, which offers all of the functionality currently available in Novell Application Launcher (NAL) 2.5 and Novell Workstation Manager 1.1. The Z.E.N.works Starter Pack is a desktop management tool that uses NDS to simplify the process of managing Windows-based workstations. The Z.E.N.works Starter Pack also makes the network easier for users to use. If you like the Z.E.N.works Starter Pack, you can purchase the complete Z.E.N.works product, which offers even more functionality. For example, this product allows you to take control of workstations from a remote location and to conduct an inventory of these workstations. (For more information about Z.E.N.works, see "Z.E.N.works Zeroes in on Workstations," <i>NetWare Connection</i> , Apr. 1998, pp. 28-34. You can download this article from http://www.novell.com/nwc/apr.98/zen48/ .)



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What's Enhanced in NetWare 5

NetWare 5 includes many management and performance enhancements to NDS, including several new security features.

Feature	Description
Catalog services	NetWare 5 includes catalog services, which provide a flat-file, customizable catalog of the Novell Directory Services (NDS) database. With catalog services, both developers and network administrators can easily write applications that can search the NDS database and extract particular NDS information (for example, users' names and telephone numbers).
Contextless login	NetWare 5 includes a sample application that demonstrates the capabilities of catalog services. This application allows users to log in to the network from anywhere without having to specify their NDS context—a capability that is called contextless login. For example, suppose that user Jane tried to log in to the network from a workstation outside her NDS context, entering only her first name in the login screen. The application would scan the catalog (rather than parsing the NDS database) and quickly return a list of all users in the NDS tree with that first name. Jane could then simply select her own name from the list and continue the login process as usual.
WAN Traffic Manager	NetWare 5 includes both a WAN Traffic Manager NetWare Loadable Module (NLM) and a WAN Traffic Manager snap-in module for Novell's NetWare Administrator (NWADMIN) utility. With WAN Traffic Manager, you can create policies for controlling NDS replication traffic over WAN links. For example, you could create a policy specifying that the NDS servers at your company's branch offices should exchange replication information with the NDS server at your company's corporate office only between midnight and 3:00 a.m Monday through Friday.
Lightweight Directory Access Protocol (LDAP) support	NetWare 5 supports LDAP version 3, an industry-standard protocol that allows users to easily access X.500-based directories such as NDS. In NetWare 5, the performance of LDAP access to NDS has been significantly enhanced. NetWare 5 also includes LDAP Services for NDS, which is a server-based interface between NDS and LDAP-compliant applications running under Secure Sockets Layer (SSL).
Cryptographic services	NetWare 5 includes cryptographic services that are code-named Novell International Cryptographic Infrastructure (NICI). NICI allows developers to use the Controlled Cryptography Service (CCS) application program interface (API) to integrate cryptographic schemes with their applications. NICI also allows developers to write a single application that can be used in several countries, regardless of the differences in countries' cryptographic laws. For example, a developer could write a single application that uses 128-bit cryptographic keys when used within the United States and 40-bit cryptographic keys when used within countries that allow only keys of that length.
Secure Authentication Services (SAS)	NetWare 5 includes SAS, an infrastructure for supporting both existing and emerging authentication mechanisms, such as biometric and token-authentication systems. Through SAS, NetWare 5 also supports SSL version 3. Developers can use the SAS API to write applications that can establish encrypted SSL connections. (Developers can then use NICI to ensure that these SSL connections conform to the laws of each country in which the applications are used.)
Public Key Infrastructure Services (PKIS)	NetWare 5 includes PKIS, which supports public-key cryptography and digital certificates in a NetWare 5 environment. (Digital certificates provide a method for checking the authenticity of keys used in a public-key cryptographic session.) In NetWare 5, PKIS allows you either to act as your own certificate authority or to use the services of third-party certificate authorities. Through PKIS, you can generate and sign various types of digital certificates and store and manage these certificates within NDS.
Auditing services	NetWare 5 includes auditing services, which allow you to monitor users' access to your company's network and to record this monitoring information in audit log files. You can create NDS objects to represent audit log files, and you can then manage these objects just as you manage other objects in the NDS tree. You can also grant rights to the NDS objects representing audit log files just as you grant rights to other objects in the NDS tree. As a result, you can assign administrators to view and manage audit log files. 

NCP is actually a set of protocols that enables a NetWare server to accept and respond to requests for various network services, including creating a network connection, manipulating files and di-

rectories on the network, and printing documents to network printers.

When a workstation needs access to one of these services, the NetWare Requester that comes with the worksta-

tion's NetWare client software uses NCP to form a request packet for the service. The NetWare Requester then passes the packet to the workstation's TCP/IP stack. (In previous versions of NetWare,

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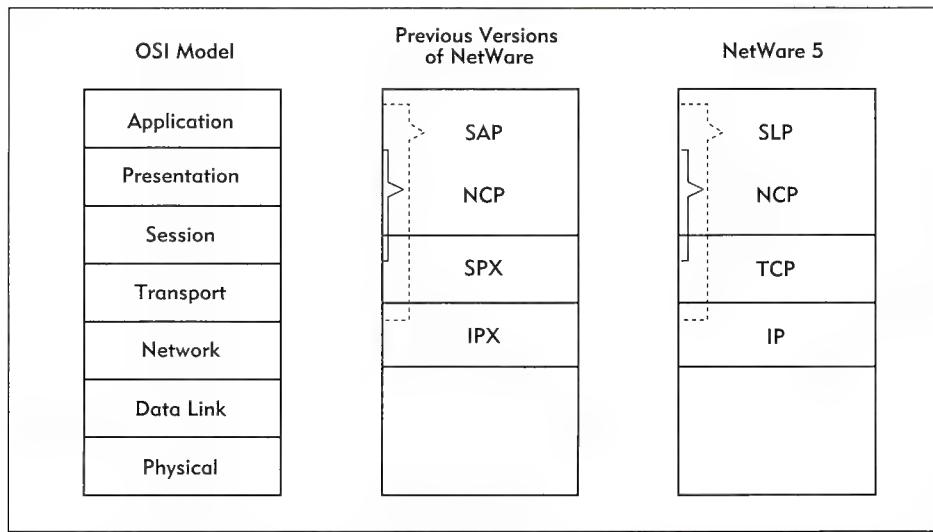


Figure 1. Unlike previous versions of NetWare, NetWare 5 uses TCP as its transport-layer protocol and IP as its network-layer protocol. NetWare 5 also uses SLP instead of SAP.

this packet would be passed to the workstation's IPX/SPX stack instead.) The TCP/IP stack attaches an IP header that indicates the packet's source and destination addresses and sends this packet over TCP/IP to a NetWare 5 server.

More specifically, NetWare 5 uses TCP to guarantee that NCP and other packets are delivered and that these packets are in the correct sequence. NetWare 5 then uses IP, rather than IPX, to address and route NCP and other packets. (See Figure 1.)

Although NetWare 5 is Novell's first pure TCP/IP network operating system, it is not Novell's first TCP/IP solution. For years, Novell has been a leading provider of TCP/IP solutions for NetWare, including IP tunneling, IP relay, the IPX-IP gateway, and NetWare/IP.

Many of these solutions (in fact, all of the solutions listed above except for the IPX-IP gateway) support TCP/IP by encapsulating it within an IPX packet at various stages of the packet's journey across the network. NetWare 5, in contrast, runs TCP/IP without encapsulation. In short, as Faustyn says, "With NetWare 5, you can get rid of IPX" on the wire.

NETWARE 5 AND JAVA—A MARRIAGE MADE IN HEAVEN

As mentioned earlier, NetWare 5 supports Java, a popular programming language developed by Sun Microsystems Inc. Although Java is only two years old, it has attracted a great deal of attention: As Schmidt pointed out in his keynote

address at COMDEX/Fall '97, there are already more than 800 Java-related books, 1,000 Java-based applications, and 450,000 Java programmers.

NetWare 5's support for Java is part of Novell's Open Solutions Architecture (OSA) initiative. OSA is not a specific product; rather, OSA is a strategic direction Novell is taking to migrate its products and services to open protocols and standards. (For more information about OSA, see the related article on p. 22.)

NetWare 5 supports Java through the following features:

- A Java virtual machine (JVM)
- ConsoleOne
- Java-based utilities
- An OSA software developer's kit (SDK)

JVM

Novell's JVM is a set of NetWare Loadable Modules (NLMs) that interprets Java scripts and executes them on a NetWare 5 server. In NetWare 5, Novell implemented the JVM at the kernel level, enabling you to develop and run any Java-based application on a NetWare 5 server. By implementing the JVM at the kernel level in NetWare 5, Novell offers a platform on which Java "just screams," says Chris Stone, Novell's senior vice president of Strategic Business Development. (See the related article on p. 22.)

Technically speaking, NetWare 5 and Java are ideally suited, according to Faustyn. "NetWare is a very thin oper-

ating system," Faustyn explains. "Because Java is its own runtime environment, it needs only a thin operating system like NetWare."

In his keynote address at COMDEX/Fall '97, Schmidt mentioned that Java running on NetWare 5 would "probably" perform better than with other network operating systems. At that time, Schmidt did not have any specific test results to support this claim. But now the facts are in: KeyLabs Inc., an independent hardware and software testing lab, used the VolanoMark benchmark to test Novell's JVM running on NetWare 5, Microsoft's JVM running on Windows NT Server, and Java implementations for leading versions of UNIX. KeyLabs determined that Novell's JVM is more than twice as fast as the nearest contender—Microsoft's JVM running on Windows NT Server.

Preliminary test results also indicate that Novell's JVM is many times faster than Java implementations for leading versions of UNIX running on similarly priced hardware. (KeyLabs conducted its tests on computers with an Intel 300 MHz Pentium II processor and 128 MB of RAM.) These test results confirm Schmidt's claim that NetWare 5 is the best platform for developing and running Java-based applications.

ConsoleOne

As part of the OSA initiative, Novell plans to gradually converge all of its management utilities into one platform—Java. In fact, Novell has already started this convergence: The third beta version of NetWare 5 includes ConsoleOne, a Java-based application that runs on any computer with a JVM, including a NetWare 5 server.

The version of ConsoleOne that is included with NetWare 5 is a GUI server console that allows you to perform basic NDS management tasks. Future versions of ConsoleOne will provide the same level of functionality—and more—as Novell's NetWare Administrator (NWADMIN) utility.

Michael Simpson, director of Marketing at Novell, explains that in NetWare 5, ConsoleOne is primarily a development framework that also provides some NDS management capabilities. As a development framework, ConsoleOne enables developers to write snap-in modules that you can use to browse and manage virtually any name space. For example,

you could use ConsoleOne to browse and manage the NetWare file system and NDS.

Simpson claims that by 1999 Novell will have ported all of its management utilities, including ManageWise and Z.E.N.works, to Java. (These management utilities will also continue to be available as NLMs.) Thus, ConsoleOne will provide a single, Java-based, GUI server console for managing all Novell products. You will also be able to manage any third-party product for which a developer has written a ConsoleOne snap-in module. Ultimately, Novell will deliver a version of ConsoleOne that you can use to manage these products from any web browser that supports Java.

Java-Based Utilities

NetWare 5 includes two Java-based utilities that you can plug in to ConsoleOne. First, NetWare 5 includes a new installation utility that offers an X-Windows-based GUI written in Java. (See Figure 2 on p. 14.) If you have grown tired of the old text-based installation utility, this utility should be a welcome change.

Second, NetWare 5 includes a Java-based utility for managing Dynamic Host Configuration Protocol (DHCP) and Domain Name System (DNS) servers. (See Figure 3 on p. 16.) You can access the DHCP/DNS management utility from ConsoleOne, or you can launch this utility from the Tools pull-down menu in the NWADMIN utility.

The DHCP/DNS management utility that is included with NetWare 5 can reduce the amount of time you spend managing your company's network. For example, this utility automates the process of assigning IP addresses to users' workstations and eliminates the problems associated with duplicate IP addresses. The DHCP/DNS management utility also automates the process of updating host names and increases security when updating these host names.

OSA SDK

To help developers write Java-based applications for NetWare 5, Novell has included the OSA SDK (an updated version of the NetWare SDK for Java). In addition to the JVM mentioned earlier, the OSA SDK includes Java scripts, Java beans, and Java class libraries, which expose NetWare APIs. The Java class li-

braries enable developers to write Java-based applications that access NetWare 5 services, such as NDS, NSS, and Novell Distributed Print Services (NDPS). (For more information about NSS, see the "NSS—Spoiling You With Space and Speed" section on p. 16. For more information about NDPS, see "NDPS: Goodbye, Queue World!" *NetWare Connection*, Oct. 1997, pp. 6-22. You can download

this article from <http://www.novell.com/nwc/oct.97/ndps07.html>.)

The OSA SDK also includes a just-in-time compiler that interprets Java codes. The just-in-time compiler converts these Java codes into machine code in real time, dramatically increasing the speed at which a NetWare 5 server runs Java-based applications. In addition, the OSA SDK includes an



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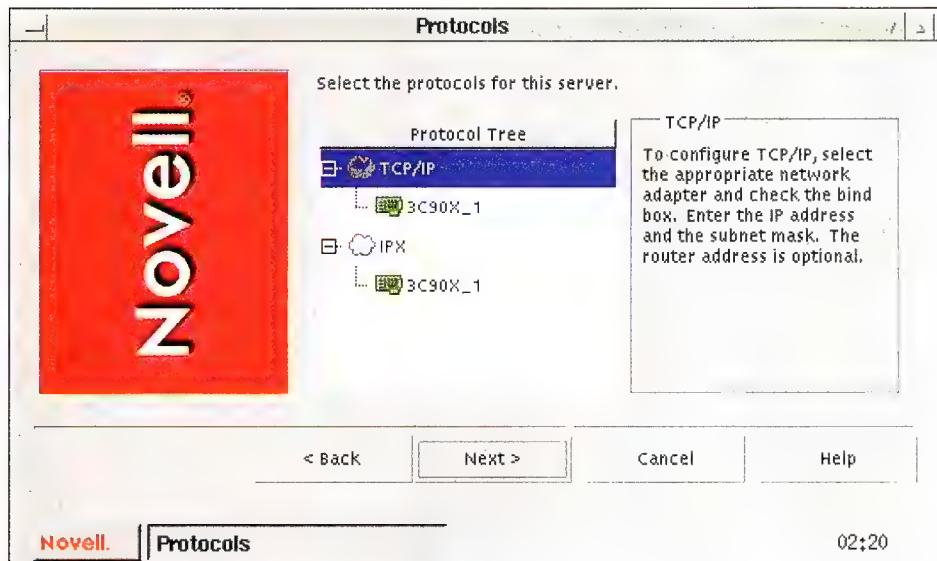


Figure 2. NetWare 5 includes a new Java-based GUI installation utility.

X-Windows-based GUI written in Java that runs on the server.

Through the OSA SDK, developers can "take advantage of quick-to-develop, easy-to-deploy Java-based applications" in a NetWare 5 environment, says Faustyn. NetWare 5, in other words, allows developers to build, test, and run their Java-based applications on the NetWare 5 operating system.

In addition, Novell plans to promote the cooperative development of Java-based applications. In fact, to jump-start Java development efforts, Novell recently announced a U.S. \$50 million fund to invest in companies developing Java-based applications. Because any Java-based application will run on a NetWare 5 server, this fund ensures the development of a potentially huge number of applications for the NetWare platform.

NETWARE 5—AN IDEAL APPLICATION SERVER?

You may be able to run Java-based applications on a NetWare 5 server, but does NetWare 5 really provide a good environment for running applications? The answer, according to Novell, is an emphatic "yes."

In addition to supporting Java, NetWare 5 supports the industry-standard Common Object Request Broker Architecture (CORBA). CORBA enables Internet and intranet users to share objects, such as data and applications, regardless of platform.

Like Java support, CORBA support is part of Novell's OSA model. (For more

information about the OSA model, see the related article on p. 22.) Through its support for CORBA, NetWare 5 supports workstations running all kinds of operating systems, including Windows, Macintosh, and UNIX. In contrast, Windows NT supports only workstations running the Windows operating system.

Both Java and CORBA support are central to NetWare 5's success as an application server. However, NetWare 5 also includes an improved kernel, which offers some key features that solidly position NetWare 5 as an application server:

- Memory protection
- Virtual memory
- Application prioritization
- Symmetric multiprocessing

Making Applications Play Nicely Together

For years, Novell has tried to dispel the myth that NetWare is only a file and print server. Despite Novell's efforts, however, the public perception still seems to be that NetWare is first and foremost a file and print server, albeit a great one.

This perception may be inaccurate, but it is based on a few features—or lack of features—that NetWare did not offer until now. For example, with previous versions of NetWare, you can run applications, in the form of NLMs, in ring 0, where the NetWare kernel runs.

Although running applications at the kernel level offers performance benefits, doing so is also potentially risky. Operations, including application operations,

that run in ring 0 do not have a protected memory space. That is, if an operation that is running in ring 0 goes awry, this operation may start overwriting memory outside of its own address space. As a result, the NetWare operating system could crash.

Novell counters this threat by advising you to run only Novell-certified NLMs. Novell Labs subjects NLMs to a comprehensive set of diagnostic tests to ensure that these NLMs won't misbehave before granting them the "Yes, NetWare Tested and Approved" stamp of approval.

Nevertheless, if you are like other network administrators, you probably want the ability to run more applications without risking a server failure. NetWare 5 gives you exactly what you want.

With NetWare 5, you still have the option of installing NLMs at the kernel level. In fact, NetWare 5 installs NLMs at the kernel level by default.

However, NetWare 5 also allows you to install NLMs in protected mode, which provides a protected memory space. NetWare 5 installs Java-based applications in protected mode by default. Applications running in protected mode, including both NLMs and Java-based applications, cannot write to any other address space except their own. Hence, when an application running in protected mode crashes, NetWare 5 continues to run.

Depending on how you configure NetWare 5, it might acknowledge a failed application by shutting the application down, cleaning up memory, and restarting the application. But the main point is that when an application running in protected mode crashes, NetWare 5 doesn't.

Getting More Memory for Your Money

NetWare 5 also spares you the grief of dealing with problems related to insufficient memory by offering more memory whenever you need it. Of course, it's not real memory; NetWare 5 doesn't actually install additional RAM. Instead, NetWare 5 offers *virtual memory*, which is better than RAM. After all, virtual memory is free.

Virtual memory is a new feature that enables NetWare 5 to store information temporarily on the hard drive when there is not enough RAM to complete an operation. For example, when an application tries to use more RAM than

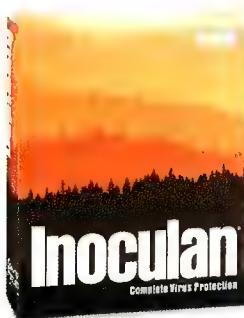
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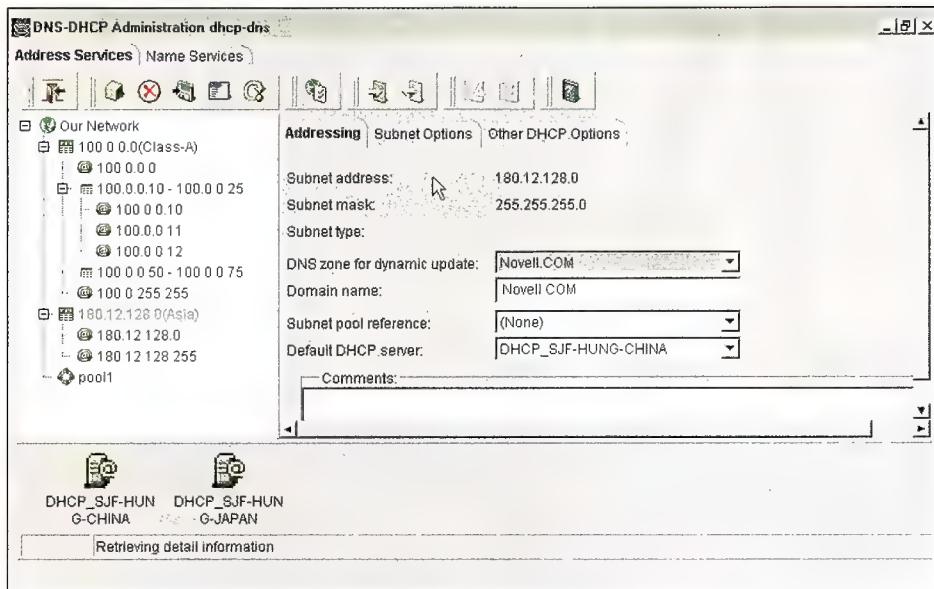


Figure 3. NetWare 5 includes a new Java-based GUI utility for managing DHCP and DNS servers.

is available on the server, NetWare 5 uses the hard drive instead, and the application can't tell the difference.

Prioritizing Applications

Unlike previous versions of NetWare, NetWare 5 enables you to prioritize the applications running on the server. You can specify how many processor cycles you want to reserve for each application when multiple applications require processing power simultaneously.

For example, suppose that a database application were running on the same server as an Internet application. Further suppose that your company's financial affairs were dependent on this database application. In this case, you might want to specify that when the database application and the Internet application require processing power simultaneously, the database application should receive 50 percent (or whatever percentage you select) of the processor cycles.

Naturally, when only one application requires processing power, that application, regardless of its priority, receives all of the processor cycles. The percentage of processor cycles you specify for each application takes effect only when multiple applications require processing power simultaneously.

Symmetric Multiprocessing

Like NetWare 4, NetWare 5 supports multiple processors. With NetWare 5, however, Novell has significantly im-

proved its support for multiple processors. For example, NetWare 5 supports single and multiple processors through the same kernel. NetWare 4, on the other hand, uses a uniprocessing kernel for servers with a single processor and a multiprocessor kernel for servers with multiple processors.

In addition, NetWare 5 supports up to 32 processors out of the box. NetWare 4 supports only four processors out of the box.

A NetWare 5 server with multiple processors can execute individual threads of a multithreaded application on different processors. In this way, NetWare 5 executes application threads simultaneously, rather than one thread at a time. As a result, NetWare 5 gets more done in less time.

To take full advantage of multiple processors in a server, applications running on the server must be multithreaded. However, with or without multithreaded applications, NetWare 5 increases performance on servers with multiple processors. NetWare 5 increases performance because some of its core processes—such as Open Data-link Interface (ODI), C-library (CLIB), RSA encryption, and routing functions—are multithreaded.

NetWare 5 can run multithreaded processes simultaneously on different processors, significantly improving performance by allowing client and server requests to be processed in parallel. Because these processes are offloaded from

the main processor, more system capacity is available for applications that are not multithreaded.

NSS—SPOILING YOU WITH SPACE AND SPEED

Novell didn't stop at improving the NetWare 5 kernel: Novell also improved the NetWare file system by developing NSS, the next-generation NetWare file system. With NSS, you can store more data on your company's network than you have ever stored before, and you can mount volumes faster than you have ever imagined.

NSS eliminates the limitations of the existing NetWare file system, while maintaining full backward compatibility with that file system. NSS runs alongside the existing NetWare file system, intercepting and handling all operations involving NSS volumes.

In addition, NSS supports any existing and future storage device, including today's DVD-ROM and DVD-RAM drives and tomorrow's holographic storage devices, which are currently under development. As Prashant Shukla, product manager at Novell, points out, NSS "has been architected with an eye toward the future."

When 2 GB Just Isn't Enough

NSS supports much larger files and volumes than the existing NetWare file system. The existing file system uses a 32-bit interface, which limits users to files no larger than 2 GB each and volumes no larger than 1 TB each. One volume can hold all of the data you could store on 50 20-GB tape cartridges.

NSS, on the other hand, uses a 64-bit interface, which allows for larger files and volumes. In fact, one volume can hold all of the data you could store on 400 20-GB tape cartridges. Specifically, NSS supports files and volumes of up to 8 TB each.

No Limits

In addition, NSS supports many more volumes per server and files per volume than the existing NetWare file system. The existing file system supports up to 64 volumes per server and 16 million files per volume.

In contrast, NSS supports an unlimited number of volumes per server and theoretically supports 2^{64} files per volume—more files than you will

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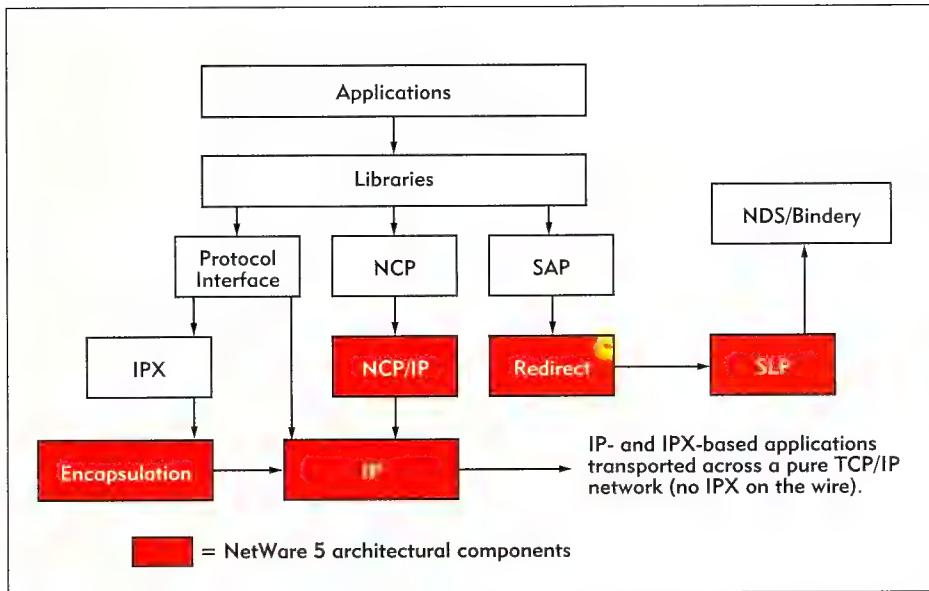


Figure 4. The NetWare 5 compatibility mode allows you to run IPX-based applications in a pure TCP/IP environment. Compatibility drivers append IP headers to the NCP calls that IPX-based applications make and also redirect SAP broadcasts to SLP.

probably generate in a lifetime. Novell engineers have already tested NSS volumes with more than one billion files.

NSS Is Fast—Really Fast

NSS volumes mount far faster than volumes in the existing NetWare file system. For example, in a demonstration at BrainShare '97 in Salt Lake City, Utah, Novell engineers mounted an NSS volume that contained 400 million files in just three seconds.

NSS volumes mount so quickly because, unlike the existing NetWare file system, NSS doesn't use File Allocation Tables (FATs) to organize storage. As a result, NetWare 5 doesn't have to load an NSS volume's entire FAT into memory to create a Directory Entry Table (DET), as previous versions of NetWare must do for the existing NetWare file system. With the existing NetWare file system, the amount of time NetWare takes to mount a volume after a clean dismount is roughly linear to the volume's size.

Instead of using FATs, NSS organizes storage by using memory-efficient organizational structures called balanced trees, or *B-trees*. With *B-trees*, NSS can retrieve any file blocks that are not in memory within four processor cycles. NSS also allows more file blocks to be stored in memory than the existing NetWare file system allows.

Because NSS uses *B-trees*, the amount of time it takes to mount a volume does

not depend on the volume's size. After a clean dismount, NetWare 5 can mount an NSS volume in a fraction of a second, regardless of its size.

Minimum RAM for Maximum Performance

Because NSS uses *B-trees* instead of FATs, NetWare 5 requires far less memory than previous versions of NetWare. With the existing NetWare file system, the amount of memory a server requires is roughly linear to the number of volumes on the server and the size of files in these volumes. The larger a volume gets, the more RAM NetWare needs to mount the volume. For example, a 10-GB volume might require 160 MB of RAM, and a 100-GB volume might require even more RAM—perhaps 1 GB of RAM.

In contrast, the size of an NSS volume has no effect on its RAM requirements. An NSS volume requires only 32 MB of RAM to mount, whether the volume is 10 GB, 100 GB, or 100 TB in size. With only 32 MB of RAM, NetWare 5 can mount any volume, even one with millions or billions of files.

Rapid Restart

Using NSS, NetWare 5 can repair NSS volumes faster than it can repair volumes in the existing NetWare file system. The existing NetWare file system first records file operations (including creating, modifying, and deleting a file)

in memory and then records these operations to the hard drive when the server is not busy. As a result, you have a problem if users make changes on a volume and the server crashes before these changes are written to the hard drive. To restore the volume, you must run Novell's VREPAIR utility, which scans the entire volume and may have to recreate FATs from scratch to match what is found on the volume. This process is time consuming, particularly if the volume is large.

In contrast, NSS associates every change to an NSS volume with a transaction. A transaction includes all of the steps required to make one change. For example, renaming a file actually involves several steps (including removing the file from the current directory and placing the file in a new directory). The transaction associated with renaming a file includes all of the steps required to make that change.

NSS records each transaction in a journal on the hard drive. After a transaction is completed (that is, after all of the steps required to make the change have been fully written to the hard drive), NSS deletes the journal entries associated with the transaction.

If the server crashes before a transaction on an NSS volume is completed, you have little to worry about. NSS can use the journal to restore the volume by redoing or undoing the recorded transactions. To restore the volume, NSS simply replays the journal, redoing the transactions that were fully written to the hard drive and undoing the transactions that were only partially written to the hard drive.

Because the size of a journal is based on expected modification rates rather than the NSS volume's size, journals tend to be small. As a result, NSS can replay a journal quickly (far more quickly than the VREPAIR utility can scan an entire volume). Thus, for an NSS volume of any size, NetWare 5 can restore the volume to health in only seconds or less. After a clean dismount, which leaves no significant transactions to replay, NetWare 5 takes approximately one-tenth of one second to remount an NSS volume, regardless of its size.

COMPATIBILITY MODE—HELPING YOU UPGRADE

With all of these big changes, you might assume that upgrading to NetWare

5 will be a nightmare. For example, what do you do with your company's existing IPX-based applications and clients if you decide to implement a pure TCP/IP environment? After all, Novell's installed base of 79 million users have NetWare servers running countless IPX-based applications and clients.

Novell recognized that these users would not have responded well if upgrading to NetWare 5 required them to change applications on every server and protocol stacks on every client. To accommodate this existing installed base, NetWare 5 includes a Compatibility Mode option, which is one of several installation options. When you select this option, you can run IPX-based applications on a NetWare 5 server and link IPX segments to IP segments with ease.

Novell believes that the need for compatibility mode will diminish over time as applications eliminate their dependencies on IPX. In the meantime, the Compatibility Mode option, as Fau-

styn explains, enables you to "control both the degree and the rate of change on your company's network as you migrate to pure TCP/IP."

Compatibility mode provides three components that essentially perform three functions:

- Client and server drivers, for application compatibility
- A migration agent, for connectivity compatibility
- A bindery agent, for bindery compatibility

Client and Server Drivers

The client and server drivers enable you to run IPX-based applications in a NetWare 5 environment—even a pure TCP/IP environment. You can enable the server drivers when you install NetWare 5 on a server, and you can enable the client drivers when you install Novell's client software on each workstation. When an IPX-based application makes an NCP call in a pure

TCP/IP environment, the client and server drivers ensure that the NCP call drops straight down to the TCP/IP stack and is sent out over the wire as an IP packet.

Some IPX-based applications, however, access the IPX stack directly. In this case, the drivers intercept the resulting IPX packets and encapsulate them within IP. (See Figure 4.) This capability is necessary only to accommodate any existing IPX-based applications that developers have written to circumvent NCP. Wilkinson estimates that such "dirty-hooked" applications make up less than 5 percent of all IPX-based applications.

Migration Agent

The migration agent provides connectivity compatibility. That is, the migration agent enables you to link IPX segments to IP segments without installing any additional hardware or software. You can enable the migration agent when you install NetWare 5. However, you

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Discovering Network Services in a NetWare 5 Environment

As you might expect, Novell's move to TCP/IP necessitated a change in the way network clients discover network services in a NetWare 5 environment. With NetWare 5, you can configure one of three options to replace the traditional Service Advertising Protocol (SAP) method of discovering network services:

- Service Location Protocol (SLP) configuration
- Dynamic Host Configuration Protocol (DHCP) configuration
- Static configuration

SLP CONFIGURATION

If you enable the Compatibility Mode option, network clients can use SLP in a NetWare 5 environment to discover the addresses of servers that offer the network services these clients need. (For more information about the Compatibility Mode option, see the "Compatibility Mode—Helping You Upgrade" section on p. 18 of the main article.) SLP provides full backward compatibility with network services and applications that rely on SAP-based discovery.

Some IPX-based applications depend on SAP to exchange information about available network services. If you do not want IPX traffic on your company's network, however, you can enable the compatibility mode client and server drivers to redirect SAP traffic from IPX-based applications to SLP, which uses IP over the wire.

If your company's network includes both IPX and IP segments, you should enable the compatibility mode migration agent. The migration agent uses SLP to advertise an IPX segment's network services on an IP segment and then uses SAP to advertise an IP segment's services on an IPX segment. The migration agent thus translates all SAP traffic into SLP traffic—and vice versa—to ensure that IP clients can discover network services on IPX segments and that IPX clients can discover network services on IP segments.

DHCP CONFIGURATION

You can also use DHCP to enable IP clients to discover network services in a NetWare 5 environment. DHCP is a standard defined by the Internet Engineering Task Force (IETF) for dy-

namically allocating IP addresses to multiple workstations on a network. In NetWare 5, you can use DHCP as part of the client initialization process and as an ongoing discovery process.

Novell included the DHCP configuration option for companies that already have DHCP servers and DHCP client software installed on each workstation. (NetWare 5 and any other server that supports DHCP is a DHCP server.)

For example, suppose that a user wanted to log in to a NetWare 5 network from a workstation that was running DHCP client software. When the Novell client software running on this workstation tried to attach to the network, the client software's NetWare Requester would send a request to the DHCP client software, asking for the IP address of the nearest server running Novell Directory Services (NDS).

The DHCP client software would then transmit a broadcast packet to locate a DHCP server, which would return the IP address of the nearest NDS server to the workstation's TCP/IP stack. The TCP/IP stack, in turn, would return the IP address to the NetWare Requester. Equipped with the IP address for the nearest NDS server, the Novell client software could attach to the network.

Because NetWare 5 integrates DHCP services with NDS, the IP addresses of all network services are stored in NDS. IP clients running DHCP client software can thus find the IP address of any network service through NDS.

STATIC CONFIGURATION

If you do not want to use the SLP configuration option or the DHCP configuration option, you can manually enable IP clients on your company's network to discover network services in a NetWare 5 environment. To do so, you simply include the IP address of one or more NDS servers on each IP client. On Windows 95 workstations, for example, you would include this IP address in a Host file.

When you include the IP address of an NDS server on each IP client, these clients use the IP address to discover network services, instead of using SLP or DHCP. For example, an IP client would use the manually entered IP address of an NDS server to discover a preferred NDS server, attach to the network, and log in. Once connected to the NDS tree, the IP client would use NDS to obtain the IP addresses of other network services. ☐

need the migration agent only if you have both IPX and IP segments that must communicate with one another.

For example, suppose that your company's Accounting department were running a departmental, IPX-only NetWare 4 LAN and that your company's Sales department were running a departmental, IP-only NetWare 5 LAN. Obviously, the Accounting department would have IPX clients, and the Sales department would have IP clients. So what would you need to do to ensure that the IPX and IP clients in these departments could communicate with one another? Very little, thanks to the migration agent.

Basically, the migration agent knows what is happening in both the IPX and the IP segments and can route any information that needs to be exchanged between the two segments. For an IPX segment, the migration agent uses the Service Advertising Protocol (SAP) to broadcast the segment's network services. In this way, the migration agent announces itself as the nearest hop for IPX clients seeking network services on the IP segment.

For an IP segment, the migration agent uses the Service Location Protocol (SLP), which is new to NetWare 5, to broadcast the segment's network services. Again, the

migration agent announces itself as the nearest hop for IP clients seeking network services on the IPX segment.

SLP is an industry-standard protocol defined by the Internet Engineering Task Force (IETF) in Request for Comments (RFC) 2165. Clients and servers use SLP to discover network services in a TCP/IP environment. (NetWare 5 provides several options for discovery services, in addition to SLP. For more information about these options, see "Discovering Network Services in a NetWare 5 Environment.")

SLP, which uses IP over the wire, allows clients to query the network to

obtain a quick list of available network services. SLP does not generate the overhead that is characteristic of SAP. SAP is a "chatty protocol," Wilkinson explains, that broadcasts the availability of a network service every 60 seconds.

In contrast, SLP maintains a registry of all network services in NDS and registers a particular service's availability only once when that service first becomes available on the network. (A future issue of *NetWare Connection* will discuss SLP in more detail.)

In addition to providing both SLP and SAP services, the migration agent routes IPX traffic to each IP segment, and vice versa. For example, when an IPX client sends a request packet for a network service that resides on an IP segment, the migration agent intercepts the packet, encapsulates it within IP, and routes the packet to the appropriate server on the IP segment. Similarly, when an IP client sends a request packet for a network service on an IPX segment, the migration agent intercepts the IP packet, encapsulates it within IPX, and routes the packet to the appropriate server on the IPX segment.

Gradually, as you migrate to pure TCP/IP, you will eliminate the need for the migration agent. However, some companies may use the migration agent for years. For example, suppose that your company had an IP-only NetWare 5 LAN at the corporate office and nearly 150 branch offices running only IPX. Upgrading each branch office to NetWare 5 would be a time-consuming task that you might want to avoid. Accordingly, you could enable the migration agent on a NetWare 5 server so the branch offices could communicate with the corporate office, and vice versa. In such cases, the migration agent offers a practical, long-term solution.

Bindery Agent

The bindery agent provides full backward compatibility to the NetWare 3 bindery, enabling IP clients to access bindery information. If you are using IPX-based applications that are dependent on the NetWare 3 bindery, you should enable the bindery agent when you install NetWare 5.

CONCLUSION

NetWare 5 includes several new and enhanced features in addition to

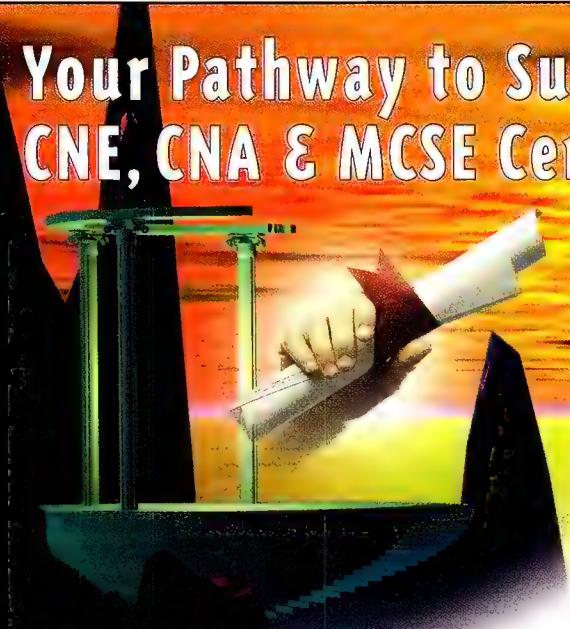
the ones discussed in this article. In fact, NetWare 5 includes so many new and enhanced features that it does the product an injustice to mention so few of them. (For a summary of these features, see "What's New in NetWare 5" on p. 8 and "What's Enhanced in NetWare 5" on p. 10.)

But the key change, the change that characterizes NetWare 5 as a revolution-

ary product, is its support for open protocols and standards, including TCP/IP, Java, CORBA, DHCP, DNS, and SLP. From the IPX/SPX-dependent to the TCP/IP-ready, NetWare 5 offers something for everyone.

Linda Boyer works for Niche Associates, which specializes in technical writing and editing. Niche Associates is based in Salt Lake City, Utah. •

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Chris Stone

Novell's Senior Vice President Explains the OSA Initiative

Linda Boyer

NetWare Connection recently interviewed Chris Stone, senior vice president for Strategic Business Development at Novell. Chris is leading Novell's efforts to provide a single software developer's kit (SDK) that contains the application program interfaces (APIs) and tools developers need to create and run Java-based applications on all Novell products. The business initiative driving these efforts is called Open Solutions Architecture (OSA).

The OSA initiative represents Novell's unified strategy to move all of its products and services to open protocols and standards—specifically, to Java. By basing future offerings, such as NetWare 5, on the OSA initiative, Novell will provide network-aware solutions that are open, manageable, secure, and distributed. And even more important, Novell will provide network-aware solutions that meet the needs of its customers. (For more information about the OSA initiative, visit the OSA home page on Novell's World-Wide Web site at <http://www.novell.com/osa>. From this home page, you can access a variety of resources, such as the OSA Strategy Brief and answers to frequently asked questions about the OSA initiative.)

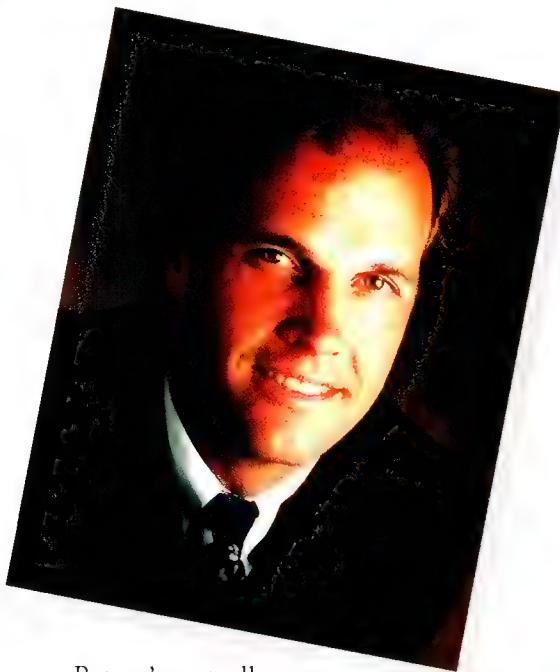
In this interview, Chris explains the OSA initiative in relation to NetWare 5. Chris also discusses the effects of Novell's move to provide an open, Java-based networking platform.

NC: What is Novell's OSA initiative?

Chris: OSA is a piece of our overall strategy, which we rolled out at BrainShare '98. Our overall strategy has to do with what we're calling an intelligent network platform. The OSA piece of that strategy is primarily about Java application development and deployment.

With NetWare, Novell already has the largest networking platform. With OSA, we're just expanding that platform to attract more developers. We're adding Java APIs and tools to help developers create Java-based applications for NetWare 5. In essence, OSA makes NetWare 5 a very viable development and deployment platform for the Internet—and that's exactly what we're trying to do.

In fact, from a management perspective, an Internet-server perspective, a storage, file, and print perspective, Java support—together with our existing services—rounds out an architecture for the Internet that you can't get from other vendors today. Most network operating systems are general-purpose operating systems that add web server capabilities.



But we're actually customizing NetWare 5 specifically for the Internet.

NC: What are the benefits to developers in making NetWare 5 a Java-based platform?

Chris: Performance, clearly. Many developers who are writing applications in C and C++ are now moving to Java. These developers need a fast platform, and NetWare 5 is certainly going to provide that. Java on NetWare 5 just screams, period. Based on recent benchmarks, NetWare 5 offers the fastest Java-based platform in the world. [For more information about the performance of NetWare 5 as a Java-based platform, see the related article on p. 6.]

Developers are also looking for web server software that runs on NetWare 5, and to that end, we've ported Netscape's web server software to the NetWare platform. Netscape's web server software runs about 30 percent faster on NetWare 5 than on any other platform. So again, the benefit of NetWare 5 as a Java-based platform is really performance.

In addition, there is the issue of a tool set, which we plan to expand. Most developers are looking for good tools. If the tools are simple, have a solid set of APIs that provide a stable environment, and don't change across multiple platforms, developers are happy. Developers don't like writing something two or three times across two or three platforms or recompiling code. So the easier we make our tools, the better. And Java-based tools are becoming easier and easier to use, especially when they are deployed from the server.

NC: Will Java-based applications running on NetWare 5 eliminate the need for NetWare Loadable Modules (NLMs)?

Chris: Java-based applications and NLMs will coexist within NetWare 5. NLMs written in C and C++ are still the preferred mechanism for development on NetWare 4, NetWare 4.11, and even NetWare 5. But over time, Java on the server will certainly become the preferred development model.

NC: What is the greatest challenge Novell faces in making the move from proprietary protocols to open protocols?

Chris: The greatest challenge is a cultural one. Novell was built over the past 13 or 14 years on the premise of "We can do it better." After all, Novell invented the LAN. So here's a company that basically invented a space, and everyone else had

to play catch-up. Not only did they play catch-up, but the rules changed when the user interface to the Internet became more popular.

The popularity of this user interface dictated a new platform. For Novell to compete, we had to make substantial changes in our thinking. We didn't invent TCP/IP; we're only supporting it and other open protocols. So Novell is having to change its thinking fairly dramatically on the inside. That change is happening. We're getting through it. But I think that this cultural challenge is one of the biggest challenges we have to deal with.

NC: How will moving to open protocols affect Novell's product sales?

Chris: Revenue. Let's face it, the IPX and SPX protocols certainly made Novell. They are fast protocols. But the world has changed. Now performance is measured on the Internet in terms of access to web pages and access over a large pipe. So the speed of a company's caching technology is a good example of a performance measurement. For Novell to compete, we had to join the standards efforts, and to do that, we had to support open protocols.

Novell has been labeled as being late to the Internet game primarily because we didn't have a native implementation of TCP/IP. But NetWare 5 implements pure TCP/IP and thus provides the platform necessary for running Internet applications. Ultimately, we would like to see companies migrate to NetWare 5 as their Internet platform of choice.

NC: Will Novell eventually phase out support for IPX/SPX entirely?

Chris: No. Old protocols never die. There will always be some sort of IPX/SPX compatibility in our products because thousands of utilities and applications use IPX/SPX. We can't eliminate it. Yes, migration to TCP/IP will happen over time, and that's exactly what we want. We want pure TCP/IP to be the protocol for NetWare 5. But when you get NetWare 5, you'll certainly be able to use IPX-based applications.

NC: Why did you decide to join Novell in September 1997?

Chris: Eric [Schmidt, Novell's chief executive officer]. I've known Eric for

years. Before I came to Novell, I ran the Object Management Group and came up with a standard platform for distributed computing called CORBA [Common Object Request Broker Architecture]. And Eric, as you know, was at Sun Microsystems and came up with this thing called Java. We used to compete as to which one would win. I guess it ends up that both Java and CORBA will win, in some respects.

So I'm at Novell primarily for three reasons: One, I wanted to work for Eric. Two, I wanted to get back into a large software company. And three, I believe Novell is a company that can really differentiate itself and help drive the Internet forward. Novell is where every other vendor wants to be, and I want to keep it that way.

Linda Boyer works for Niche Associates, a Utah-based writing agency. •

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Oracle8 for NetWare



Terry L. Jeffress



At BrainShare '98 in Salt Lake City, Utah, Novell and Oracle announced that both NetWare 5 and NetWare 4.11 will include a five-user version of Oracle8 for NetWare. This announcement capitalizes on the ongoing partnership between Novell and Oracle. Earlier this year, Oracle released Oracle8 for NetWare, which integrates the industry-leading database with the industry-leading network operating system. The combined power of Oracle8 and NetWare enables high-speed transactions, high-performance decision support systems, and sophisticated database applications.

In addition to providing new features, Oracle8 offers more design options, eliminating many of the design limitations of Oracle7. These design options mean less work for you and your company's database designers. For example, Oracle8 allows you to create enormous tables with up to 1,000 columns. (Oracle7 limits tables to 254 columns.)

Many articles within the computing industry anticipated that Oracle would radically change its database software, moving from a relational database to an object-oriented database management system (OODBMS). (An OODBMS would enable object-oriented languages such as Java and C++ to store objects directly in the database.) Although Oracle8 offers some object-oriented features, it is still primarily a relational database. A radical change would have required companies to rewrite many of their Oracle7 applications to make them work with Oracle8. Instead, Oracle8 provides almost complete backward compatibility.

In short, Oracle8 is a scalable database management system that can hold more data than ever before and deliver that data reliably and securely to many users.

A word of caution: for my research, I used a beta version of Oracle8. I cannot guarantee that all of the features mentioned in this article will actually be part of the shipping version of Oracle8 or will work exactly as I have described.

ORACLE'S VISION OF THE FUTURE

Oracle is positioning Oracle8 as more than just a database. Since high-performance networks are now within the budgets of most companies, it makes sense to gather all of the data currently stored on various servers and workstations and to store that data in a centralized database, which provides more scalability, reliability, and security.

If you are planning to centralize your company's data, why not do the same with applications, too? Storing applications as objects in the database simplifies the process of managing these applications. For example, if you upgraded an application that were stored in the database, users could immediately access the latest version of this application. In addition, if you store applications in a database, you can monitor software licenses, control users access to applications, and protect the applications from viruses.

Figure 1 shows Oracle's vision of the future of network computing, which includes not only today's servers and workstations but also network computers (NCs). An NC is a low-cost workstation that stores almost no software locally. When users start up an NC, the NC loads its operating system and all its applications directly from the network. (The term NC is also used to refer to other microprocessor-controlled devices, such as telephone, heating, and sprinkler systems, each of which load software from the network and store data in the database.)

NEW FEATURES AND DESIGN OPTIONS

Oracle8 offers several new features that make Oracle's vision of network computing a possibility. Oracle8 also provides solutions for some of the design limitations in Oracle7.

Scalability

If you have a large Oracle7 database, you probably overcome the size limitations (such as the 254 column limit) by

splitting data into separate tables stored on separate servers. Oracle8, however, allows you to create tables with up to 1,000 columns and to partition these tables, splitting a single table across multiple storage devices. Whereas the size of an Oracle7 database has a practical limit of 2 terabytes, an Oracle8 database can theoretically hold several petabytes (1,024 terabytes) of data—although finding an adequate storage solution might prove difficult.

Unlike Oracle7, Oracle8 also supports large objects (LOBs), which are designed to store unstructured data. One LOB can hold up to four gigabytes of data and can be stored in a file external to the database.

In addition, Oracle8 supports more concurrent users than Oracle7. In fact, Oracle has run benchmark tests demonstrating support for 50,000 concurrent users. Oracle8 leaves more server resources available to support additional users by reducing the per-user memory overhead on the server by 30 to 60 per-

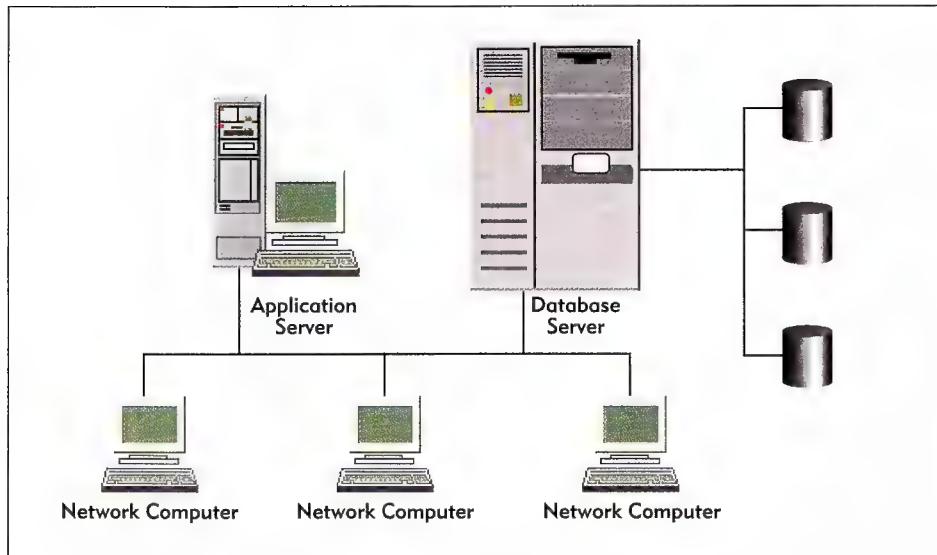


Figure 1. As Oracle envisions the future of network computing, users will use network computers and will store data in a centralized database.

cent. Oracle8 also leaves more server resources available to support additional users by including Advanced Queuing Facility (Oracle/AQ), a server-based

message and queuing technology that allows updates to be stored for later delivery. (Oracle/AQ is explained in more detail later in the article.)

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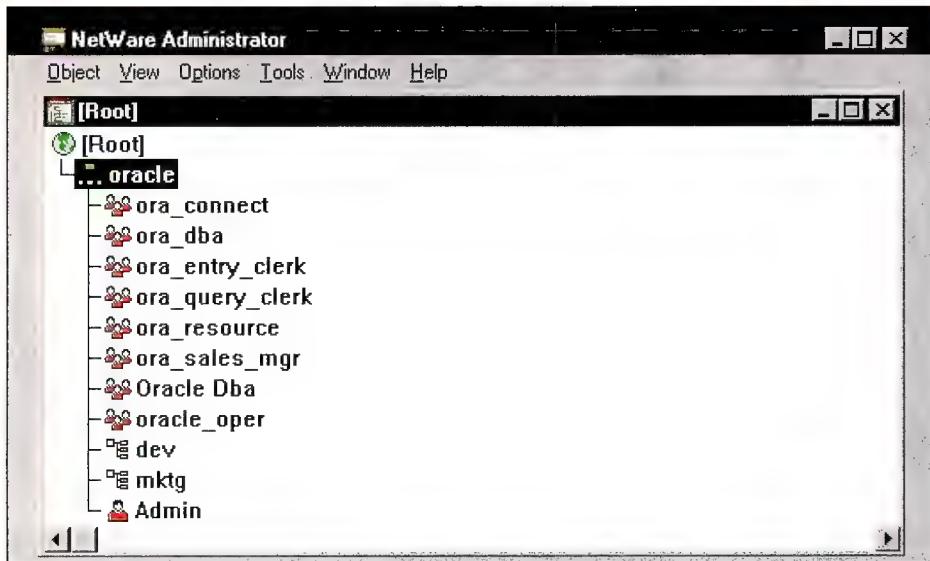


Figure 2. Oracle8 extends the NDS schema, adding objects to the NDS tree that you can then view and manage through the NWADMIN utility.

Reliability

If a database is going to replace workstation hard drives, server reliability becomes more important than ever before. Today, if the network goes down, most users can still find some useful work that they can perform on their workstations. But in a network of NCs, having the server go down would mean that all users could not access data.

To ensure server reliability, Oracle8 allows you to use disk mirroring technologies, such as Redundant Array of Independent Disks (RAID). Oracle8 also includes the following technologies:

- Oracle Parallel Server
- Recovery capabilities

Oracle Parallel Server enables separate servers running Oracle8 to share a single physical database. This parallel server support has been enhanced in Oracle8. As a result, Oracle8 can recover from the failure of a parallel server without requiring any intervention from a network administrator and with a minimal disruption of service.

In the rare event of a major server failure—one in which data is lost—Oracle8 can use archived redo logs to recover from a data loss faster than Oracle7. Oracle8 can even take advantage of multiple processors in a server to perform the recovery process.

In addition, Oracle8 offers a wizard-driven interface that greatly reduces the chance of human error during the re-

covery process. This interface is part of Oracle8's new Recovery Manager utility, which makes the task of managing backup and recovery a lot easier than it is with Oracle7.

Oracle8 also includes a new utility called DB_VERIFY, which ensures the logical integrity of data stored in the database. You can use the DB_VERIFY utility to diagnose problems if the database contains some corrupted data. You can even use the DB_VERIFY utility on an offline database, which means that you can verify data integrity for backups as well as for the online database. With Oracle7, the only way to verify data integrity is to periodically export the data. Because Oracle7 verifies each piece of data as it is being exported, the verification process takes a long time, especially for a large database.

Security

Since Oracle wants the database to be the repository for both data and applications, the database must provide not only high availability but also tight security. As a result, Oracle8 must offer sufficient security features, and you must implement stringent security policies to protect your company's data.

Many users prefer to store data on their workstation hard drive and are reluctant to store this data in a database. Users worry that the data will be less secure if stored in the database.

However, the reverse is true. Although users have few concerns about

storing data on their workstation hard drive, this data is then vulnerable to the following threats:

- A stolen workstation without any backups
- A hard drive failure (again, without any backups)
- Other users using the workstation or accessing this workstation via a network connection

Oracle8 offers better security features than Oracle7. For example, Oracle8 includes enhanced native password management capabilities:

- Oracle8 disables user accounts after a specified number of failed access attempts.
- Passwords can expire, and users can be required to regularly change their password.
- Users can be required to use a unique password.
- Users can be required to use a password that potential intruders cannot easily guess.

Of course, if you take advantage of Oracle8's integration with Novell Directory Services (NDS), Oracle8 uses NDS to provide these security features, as well as some additional benefits. (NDS integration is explained in more detail later in the article.)

More Tools to Manage Data

To support a large amount of data, Oracle8 needed a way to manage that data. A large amount of data generally results in huge tables that quickly become difficult to manage. For example, backing up a large table or recreating an index for a large table can be very slow. Even loading new data into a large table takes a long time.

With Oracle7, you can get around these problems by partitioning large tables into several smaller tables and by creating views that merge these smaller tables. Oracle8, however, supports partitioned tables that can be split across multiple storage devices. Although the data is partitioned, Oracle8 provides partition transparency, which enables applications to access the data as if it were stored on a single storage device. Oracle8 even allows you to partition database indexes.

To make data more manageable, Oracle8 also allows you to create an index-only table. As the name implies, an *index-only table* contains index blocks but no data blocks. An index-only table is useful when you don't need the actual data stored in the database, but you do need to verify that a value exists and is, therefore, valid.

More Copies of Data

Oracle8 includes enhanced support for data replication. Whereas Oracle7 uses triggers to implement data replication, Oracle8 implements data replication through code in the kernel. This implementation is far more efficient and less prone to errors than the triggers used in Oracle7.

In addition, Oracle8 includes a technology called *parallel propagation*, which enables you to replicate data more quickly. With parallel propagation, you can propagate modified data on one server simultaneously to many other servers on the network.

The data replication capabilities in Oracle7 do not support any tables containing the LONG data type (typically used to store text-based data) or the LONG RAW data type (typically used to store binary data, such as applications or multimedia files). Oracle8, however, replaces the LONG and LONG RAW data types with the LOB data type, which can be replicated (although the BFILE data type—Oracle8's data type for storing binary data—cannot).

More Ways to Represent Data

Oracle7 provides a basic set of scalar data types (CHAR, DATE, NUMBER, LONG, LONG RAW, RAW, ROWID, and VARCHAR). Oracle8 has expanded this set of scalar data types by offering a new data type system that supports more complex data structures.

Within certain limitations, you can now use Oracle8's abstract data types (ADTs) to define your own data types. You can define scalar data types or more complex data types, such as a record. For

example, a record could be all the data types necessary to comprise a customer's billing and shipping addresses.

The LOB and BFILE data types do not have the same restrictions as the LONG and LONG RAW data types. The main difference between the LOB data type and the BFILE data type is that Oracle8 stores the LOB data type within the database. As a result, this data type is subject to the database's transactional controls.

The BFILE data type, on the other hand, resides outside the database and is, therefore, not subject to these transactional controls. You can manipulate both the LOB data type and the BFILE data type from within PL/SQL, the programming language that Oracle created to extend SQL.

In addition, Oracle8 no longer restricts you to scalar data types within a table. Tables can contain variable arrays (VARARRAYs) and nested tables. A VARRAY, which is part of Oracle8's expansion toward an OODBMS, is an ordered



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"A rich and consistent set of command options permits logging in to be tailored and specific operations to be performed with a minimum of reliance on other programming."
—Dr. Tom Barton, Director, Network Services, University of Memphis

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collection of objects. A *nested table* is a table that appears as a column in another table.

Faster Access to Data

Oracle8 offers significant performance improvements over Oracle7. For example, Oracle8 includes parallel bitmap star query technology, which is of particular benefit to data warehouse applications. This technology allows Oracle8 to simultaneously process queries to bitmap indexes, star queries, and star joins.

As mentioned earlier, Oracle8 also includes the server-based Oracle/AQ technology, which provides a messaging and queuing system between the database and database applications. Because Oracle/AQ allows both users and database applications to queue a message rather than insisting on processing the message immediately, this technology provides high transaction throughput from database applications.

For example, suppose that your company processed orders for its products by using Oracle8 with several database applications—including an ordering application, an accounting application, and a shipping application, all of which were written to take advantage of queuing.

When a customer placed an order for a particular product, the ordering application would send a message to the accounting application, which would generate a bill for the product. Next, the accounting application might send a message to the shipping application, which would generate a packing slip for the product.

Instead of being processed immediately, these messages would be sent from one database application to another through application queues, in much the same way that print jobs are sent to printers through print queues.

ORACLE8 AND NDS

Oracle8 is integrated with NDS, providing single login and native naming capabilities. With a single login, users are automatically authenticated to Oracle8 based on their authentication to the NDS tree. No separate usernames and passwords are needed, and the login process is protected by the security features of NDS. With native naming, users can connect to Oracle8 by specifying the database object name in the NDS tree,

instead of by specifying an Oracle service name.

Because Oracle8 takes most user account information from the User objects in the NDS tree, you do not have to maintain two separate user directories. As a result, the cost of managing Oracle8 is reduced. In addition, NDS enhances Oracle8's security features in the following ways:

- **Administrator Authentication.** With NDS, you can create a Group object for database administrators. By making a user a member of the database administration group, you grant the user rights to connect to Oracle8 and to start or stop the server. Using Novell's NetWare Administrator (NWADMIN) utility, you can assign Oracle8 administration and access rights to any User, Group, or container object.
- **User Authentication.** With NDS, you can map User objects to Oracle8 user accounts. For example, you could map a particular User object to a particular Oracle8 user account, or you could map either a Group object or an Organizational Unit (OU) object to one Oracle8 user account. If you mapped an OU object to one Oracle8 user account, new NDS users created within that OU object would immediately have access to Oracle8 through the users' security equivalence to the OU object.
- Oracle8's integration with NDS is independent of the networking protocol being used to connect to Oracle8. Thus, users do not have to use IPX to access Oracle8. Oracle8 still authenticates users through NDS, but they are free to access Oracle8 through any network protocol that is implemented on the network.
- **Role Identification.** With NDS, you can enable an Oracle8 role—a set of access controls within the database—based on the Group object to which a particular user belongs. Just as you can map User objects to Oracle8 user accounts, you can map Group objects to Oracle8 roles.

Extending the NDS Schema

Oracle8 extends the NDS schema, adding new objects to the NDS tree and adding new properties to all User, Group, and OU objects. For example, Oracle8 adds an Oracle Instance object

to the NDS schema. (See Figure 2 on p. 28.)

Through the NWADMIN utility, you create and manage an Oracle Instance object in the same way that you create and manage other NDS objects. You can use the Oracle Instance object to perform almost all configuration tasks for Oracle8 user accounts.

No other implementation of Oracle8 provides such a complete integration of the security features offered by the database and the network operating system. As a result, database administrators can delegate security management to network administrators.

Even if you are not familiar with Oracle8, you can control users' access to Oracle8 through NDS. In addition, since the Oracle Instance object is just another object in the NDS tree, you can even deny selected users the right to browse for this object by making the object invisible to these users.

CONCLUSION

Oracle8 for NetWare brings the latest in database technology—such as large tables, partitioning, and some object-oriented functions—to the NetWare platform. Not only is Oracle8 a superior product on its own, but Oracle8 for NetWare provides users with easier access to the data they need. Oracle8 also provides network administrators with the luxury of managing the database from a central location using NDS and the familiar NWADMIN utility.

For more information about Oracle8 for NetWare, you should check out the following World-Wide Web sites:

- Visit the Oracle8 page on Oracle's web site (<http://www.oracle.com/st>). If you live in the United States or Canada, you can also call 1-800-672-2531. If you live outside the United States or Canada, you can contact your local Oracle sales office. (For a complete list of sales offices, go to http://www.oracle.com/corporate/sales_offices/html/index.html.)
- Visit the NetWare 5 page on Novell's web site (<http://www.novell.com/netware5>). You can also call 1-800-NETWARE or 1-801-861-5588.

Terry L. Jeffress works for Niche Associates, an agency that specializes in technical writing and editing. 

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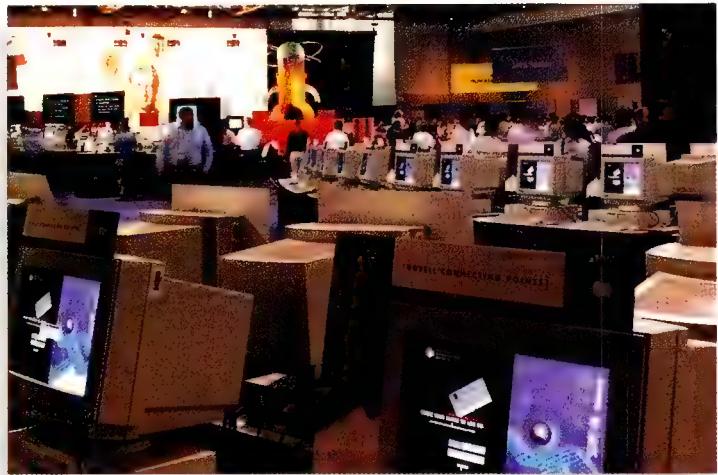
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Talking to Novell Executives at BrainShare '98



What a difference a year makes! At BrainShare '98 in Salt Lake City, Utah attendees seemed more interested in Novell's marketing efforts than in its technological advances. BrainShare '98, however, was business as usual: Attendees were once again talking about Novell's new products. Stewart Nelson, senior vice president of the Novell Products Group, explains: "A year ago, the big complaint was that we had these great products, but we were not marketing them. I'm not hearing that too much this year, because we now have John Slitz [senior vice president of Marketing], who is really marketing our products."

"The second thing I heard last year was that Novell had no focus—we were all over the map. This year, we have focused on our core competency."

"We now have a focus, and we are marketing our products. So from my perspective, things are thousands of times better than they were last year."

At BrainShare '98, *NetWare Connection* talked to several Novell executives who pointed out the progress that Novell has made. For example, Stewart also explained how Novell has changed its business practices: "This is fundamentally what John Slitz has said: If you don't have a marketing plan, don't develop the product. I'm a programmer who became a business person, so I know from both sides what it's like not to have a fully developed plan for both development and marketing. The biggest complaint programmers have with marketing is working really hard on a product and then having that product ship away into silence. I work closely with Ed McGarr [vice president of Product Marketing] to ensure that development and marketing happen in parallel."

NETWARE 5

Of course, the big news at BrainShare '98 was NetWare 5. *NetWare Connection* asked Jim Greene, manager of Product Marketing, several questions about NetWare 5: [For more information about NetWare 5, see the related article on p. 6.]

Q: How many beta customers does Novell have?

A: We have been overwhelmed. This has been probably the most frustrating and most rewarding exercise all at once. We planned for 40,000 beta customers, which is double what we had for intraNetWare. We hit 40,000 beta customers before we even blinked and just raced right on by.

With NetWare 5 Beta 2, we have more than 70,000 beta customers at last count, and we may have more. With NetWare 5 Beta 3, we'll definitely have more than 150,000 beta customers, and we haven't seen the end of the demand

yet. Just to put it into perspective, if half of these beta customers purchased NetWare 5, that would be 75,000 servers, which would be a record quarter for a new product. [For more information about NetWare 5 Beta 3, see "Novell News" on p. 44.]

Q: What features do beta customers seem to be interested in?

A: The main attraction for NetWare 5 is absolutely TCP/IP, but people are beginning to see what we're doing with manageability and with bringing the whole network together. They're realizing that we're back to our roots and that we really do networking better than anyone.

Microsoft tried to make file and print generic because they knew that was a strength of NetWare, and if they could make file and print generic, then we'd have nothing to say. What Microsoft didn't recognize is that the network has evolved. File and print is still a vital service, but many other services are needed. Of course, we're not giving up on file and print; we're actually bringing out the next generation of file and print with NetWare 5—bigger, better, and faster. But we're moving beyond that by focusing on manageability and heterogeneity, which is the allure of NetWare 5—it brings manageability to a wide open network.

Also, you don't want to rip up and replace your company's network infrastructure. For example, I live in Utah, where the I-15 freeway is being redone. Why is that such a problem? Because we let I-15 get to the point at which we had to rip up and replace the infrastructure. It's much easier to just add a lane or to repave.

As networks grow and embrace open standards, networks are going to become more heterogeneous, not less heterogeneous. If you rip up and replace your company's network infrastructure every time a new technology comes out, homogeneous networks will work. But you don't do that—it's too painful, as we are finding out with I-15. And so as networks become more heterogeneous, manageability becomes an issue.

Q: What management tools are included with NetWare 5?

A: One of the most important management tools is ConsoleOne. Most network administrators today manage the network from a control center with multiple keyboards. Even Novell hasn't had one console. We've had a server console, an NWADMIN console, and a ManageWise console.

ConsoleOne brings all of these consoles together into one platform, using open standards so that third-party companies can add their consoles. You can even add your own console to ConsoleOne because of the open standards.

In addition, ConsoleOne runs anywhere Java runs—on a server, on a Macintosh workstation, or on a browser. With ConsoleOne, Novell offers a GUI for the server, although the C-worthy interface is still available as well.

NetWare 5 also includes the Z.E.N.works Starter Pack, which integrates NAL [Novell Application Launcher] and Novell Workstation Manager. If you want inventory capabilities, help desk integration, or other advanced features, you can purchase the complete Z.E.N.works product separately.

Q: We've also heard that NetWare 5 includes catalog services.

A: Yes. Catalog services supports a contextless login. For example, if you typed *Bob*, a list of NDS [Novell Directory Services] usernames that include *Bob* would appear. You do not need to know your NDS context to log in to the network.

In addition, the NDS database contains valuable information that you might want to make available to applications. The problem has always been that if you run a query on the NDS database, you could be contending with someone who is trying to log in to the network. And what's more important—you running a query or a user trying to access the network?

So how do you get information without disrupting the network? Since you don't need up-to-the-minute information to run a query, catalog services takes a snapshot of the NDS database and places the snapshot in a separate work space. You can then run a query on the NDS database. For example, you could find out how many workstations are year 2000 compliant or how many users' passwords have expired.

Q: When will NetWare 5 earn Class C2 certification?

A: When we submitted NetWare 4.11 for C2 certification, we took a different approach: We certified the architecture and the services. Since the architecture and the services are already C2 certified, we've eliminated about 75 percent of the retesting that would have been necessary. So we just have to retest the new pieces, and we'll be

very close. However, NetWare 5 will not be C2 certified out of the box; the product actually has to be shipping before it can earn C2 certification.

NETWARE FOR SMALL BUSINESS 4.11

Novell also recently announced NetWare for Small Business 4.11. NetWare Connection asked Stewart to explain why this product is now more attractive to small businesses.

Q: How has Novell improved NetWare for Small Business 4.11?

A: We looked at what was wrong with the current product, and the first thing we saw was the preinstall. You had to go through DOS partitioning just to get the server configured. So we put some of our best people in a room and said, "Solve the preinstall issue."

The preinstall has gone from something that was difficult to do to something you can do in about 20 minutes. You answer seven or eight questions, and all of the partitioning takes place behind the scenes.

In addition, we're bundling Oracle8 and some products from Computer Associates, including FAXserve 5, ARCServe 6.1, and InocuLAN 4.0.

Q: Does NetWare for Small Business 4.11 include GroupWise 5.2?

A: NetWare for Small Business 4.11 does include GroupWise 5.2, which supports POP3 [Post Office Protocol 3] and IMAP4 [Internet Message Access Protocol 4]. As a result, Internet client software runs natively on top of GroupWise 5.2.

GroupWise 5.2 also has a simple installation process. Because we know GroupWise 5.2 will reside on a single server, we know how to set the environment variables. You literally select the Install GroupWise option, and when you add users to the network, you automatically get a post office.

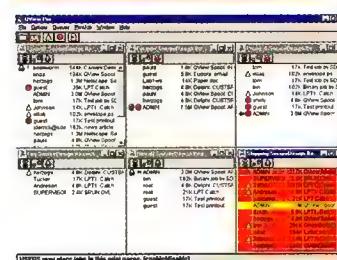
Going forward, NetWare for Small Business is not going to die on the vine. There are other things we need to put in the box, and we're working on these things as we speak. ☐

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Designing Your Company's NDS Tree

Mickey Applebaum

Editor's Note: "Technically Speaking" answers your technical questions, focusing on issues that affect network administrators. To submit a question for a future column, please send an e-mail message to nweditors@novell.com, or fax the question to 1-801-228-4576.

Over the past several years I have installed NetWare 4 on single-server networks, multiserver networks at a single location, and multiserver networks that span multiple locations. With each installation, I have tried to figure out the best way to design a Novell Directory Services (NDS) tree.

First, I read all that I could about NDS, paying particular attention to NDS tree design. Unfortunately, most of the information I read focused primarily on theory—providing more information than I needed about what and why and not enough information about when and how.

This article provides practical guidelines to help you design your company's NDS tree. Although this article does not replace a good working knowledge of NDS, it gives you a starting point for understanding NDS tree design.

BUILDING AN NDS TREE

You must first decide how to build your company's NDS tree. Should you migrate users and network resources from a NetWare 3 server to the NDS tree? Or should you migrate only data and create new NDS objects for users and network resources?

When you upgrade a NetWare 3 server to NetWare 4, users and network resources are moved to the NetWare 4 server in a flat, bindery-style configuration. (In other words, the NDS objects for all users and network resources are placed directly under the [Root] object.) Although migrating users and network resources is an easy way to start building an NDS tree, I would recommend against using this approach. You may migrate hundreds, if not thousands, of old, unused bindery objects that have been created over the years your company's network has existed. You may also encounter problems if some of these objects have been

corrupted or orphaned. Corrupted bindery objects can propagate unresolved external references throughout the NDS tree, which can slow down performance. Orphaned bindery objects, on the other hand, cannot be managed or deleted from the NDS tree. (Bindery objects contain references to other bindery objects. An *orphaned bindery object* is one that has lost its references.)

If you decide to migrate users and network resources from a NetWare 3 server, you must clean up the NDS tree after the migration process is completed. For example, you should manually add, delete, and move NDS objects as needed.

In addition, you should consider using Computer Associates' DS Standard NDS Manager, which helps you import bindery objects into NDS and design the structure of the NDS tree. With DS Standard NDS Manager, you can design your company's NDS tree and test this design before you migrate users and network resources. As a result, you can perform NDS operations—such as adding, deleting, and moving NDS objects—and determine the ramifications of these operations before you implement them in the NDS tree. If you use DS Standard NDS Manager to maintain the NDS tree, you get the added benefit of being able to use this product to rebuild the NDS tree in the event of a catastrophic failure. (For more information about DS Standard NDS Manager, visit <http://www.cheyenne.com/directory>.)

DESIGNING AN NDS TREE

Next, you must decide how you want your company's NDS tree to look. This step is the most troublesome part of implementing a NetWare 4 network. You plan, you follow the books, and you still may not know the best NDS tree design.

After years of installing NetWare 4, I finally stumbled across an NDS tree design that has, so far, fit every company I have worked with—from companies with a single server at one location to companies with multiple servers at multiple locations. This design works because it is simple and easy to understand.

Of course, I begin by creating a [Root] object in the NDS tree. I then create an Organization (O) object, assigning this object a name that is meaningful to the company. For example, if a company had a single business unit, I would use the company name. (See Figure 1.) If the company had multiple business units (such as Saturn, Dodge, and Chevrolet, which are part of General Motors Corp.), I might name the O object Enterprise or Corporate.

If your company has one location, you can skip to the "Creating OU Objects for Business Units" section. If your company has multiple locations, you should continue with the next section.

Creating OU Objects That Correspond to Locations

If your company has multiple locations, you then create an Organizational Unit (OU) object under the O object for each

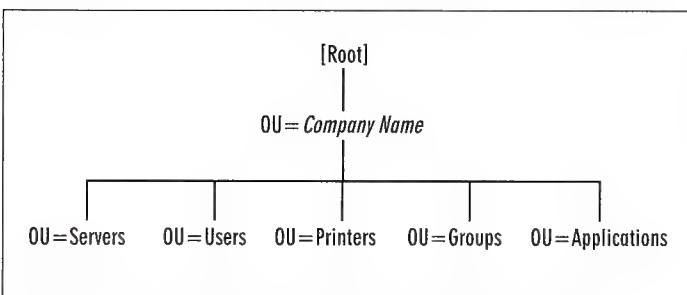


Figure 1. This NDS tree would work well for a company with one location.

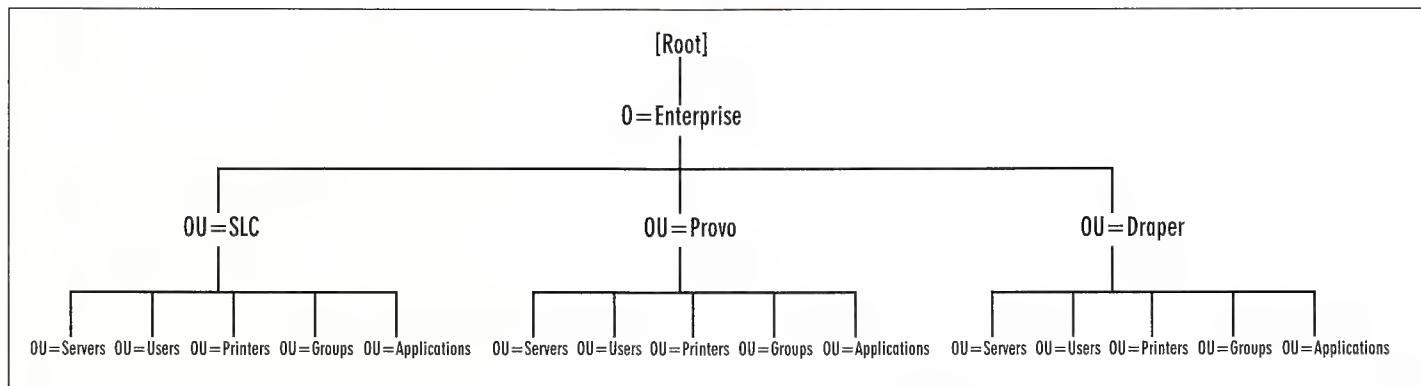


Figure 2. If your company has multiple locations, you create an O object under the [Root] object, and you then create OU objects for each location. Under these OU objects, you create high-level OU objects for specific types of NDS objects, such as Server and User objects.

location. For example, I once supported a Utah-based company with offices in Salt Lake City, Provo, and Draper. In this case, I created an OU object for each location, naming these objects OU=SLC, OU=Provo, and OU=Draper. (See Figure 2.)

If your company has offices in different states or countries, you can use state or country names. For example, if I supported a multistate company, I might create OU objects for California, New York, and Texas. If the company had multiple offices in each state, I would then add another layer of OU objects. For example, under the California OU object, I could create a Sacramento OU object and a Los Angeles OU object.

Creating OU Objects That Correspond to Business Units

After you create OU objects for each location, you create OU objects for the business units at each location. If your company has only one location, you create OU objects under the O object for each business unit.

At this point, my guidelines change from others I have encountered. You create what I call high-level OU objects, which contain specific types of NDS objects. For example, you could create a high-level OU object for User objects, Group objects, Server objects, or Printer objects and Print Queue objects. (See Figure 2.)

You can then manage login scripts, access controls, and trustee rights more easily. For example, if you wanted users in the Sales department to access particular printers, you could add the Printer objects to the Sales department's Printers OU object. Next, you could grant the Users OU object the necessary rights to the Printers OU object. You could also

enable users in the Marketing department to access one of these printers by creating an alias to the Printer object in the Marketing department's Printers OU object.

CONCLUSION

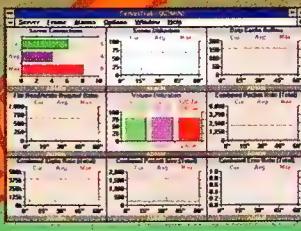
Using these guidelines allows you to expand a NetWare 4 network as needed. You can easily add locations and business units and merge NDS trees.

If your company is large, you can set up an administrator for each location or for each business unit. You can also easily identify network resources, such as servers and printers, within each business unit. Simply put, these guidelines make it easy to maintain your company's NDS tree.

Mickey Applebaum has worked with NetWare for 14 years. Mickey provides technical support on the Internet for The Tech Forums Inc. (<http://theforums.com>).

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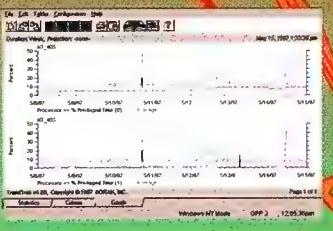


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Tap Into an Information Gold Mine

If you are like many network administrators, you are dealing with draconian budget cuts and an ever-increasing workload. When a user reports a network problem that you cannot solve, your first inclination may be to call Novell Technical Services. However, your budget requires that you keep network support costs to an absolute minimum, and telephone support can add up. According to Kevin Wade, manager of the Novell Support Connection CD team, industry research confirms that telephone support is the most expensive form of front-line support. Because telephone support is expensive to provide, it is also expensive to access.

To help you provide your company's first line of support, Novell Technical Services has developed electronic technical support tools such as the Novell Support Connection CD, which offers fast, inexpensive access to Novell's extensive networking knowledge. This article describes the benefits of using the Novell Support Connection CD and explains how you can use this CD to solve networking problems.

WHY USE THE NOVELL SUPPORT CONNECTION CD?

With a subscription to the Novell Support Connection CD, you have access to all of the resources you need to install, manage, and troubleshoot your company's network and network applications. (If you are confused about the names of Novell's technical support tools, see "One of These Things Is Not Like the Other" on p. 38.) The Novell Support Connection CD provides a comprehensive library of resources from Novell, including the following resources:

- Technical information documents (TIDs)
- Research reports and test results from Novell Labs
- Product manuals and documentation
- Documents from Novell's partners
- *Novell Application Notes*, a monthly technical publication that focuses on network design, implementation, and optimization
- *Novell Developer Notes*, a monthly technical publication that focuses on network software development
- Answers to frequently asked questions (FAQs) from Novell customers
- Software patches and drivers



Many of these resources are gathered from the records of Novell's Global Service Delivery Management System, an electronic incident logging and tracking system that collects information from Novell support technicians worldwide. As a result, the Novell Support Connection CD provides solutions to problems that users throughout the world have experienced.

Almost any solution that a Novell support technician can provide, you can find on the Novell Support Connection CD. In fact, if you call Novell Technical Services, the support technician may actually find a solution to your problem on the Novell Support Connection CD or on the Novell Support Connection World-Wide Web site. (For more information about the similarities and differences between the CD and the web site, see "Technical Support Tools for the Information Age," on p. 40.)

Unless your problem is extremely rare, it has probably been the subject of a TID or a FAQ, and Novell may have already developed a patch to correct the problem. In this case, the Novell support technician tells you to download the patch from the Novell Support Connection CD or web site and to call back if the problem persists.

If you consult the Novell Support Connection CD first, you can obtain the same resources and have instant access to the solution. You don't have to wait for a Novell support technician to answer your call or to search for a solution to your problem. You can quickly solve this problem yourself, and you don't have to pay for telephone support.

Admittedly, you do have to pay for an annual subscription to the Novell Support Connection CD. However, you may already have access to the Novell Support Connection CD if your company has a Master License Agreement (MLA) with Novell or if your company is one of the following:

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The Forums, formerly known as NetWare Users International's Technical Support Forums, is a high-end technical support solution, with an average of over 250,000 hits per month. We guarantee a response within 24 hours by one of our certified technical consultants. We provide services to Information Systems Professionals by delivering real world solutions for Novell, Cisco, Microsoft and other networking products. The Forums provides 24 hour 7 days a week, inexpensive, on-line support enabling you to manage your network effectively.

Our technicians are sought after industry professionals renowned for their innovative solutions and broad based product knowledge. In fact our consultants and technicians will be showcased as they host the NUI InterConnect demonstration labs during the upcoming 30 city NUI Users Conference tour.

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One of These Things Is Not Like the Other

Novell offers two technical support products with similar names: the Novell Support Connection CD and the Novell Software Connection Library. To help you determine which product best meets your needs, the differences between the Novell Support Connection CD and the Novell Software Connection Library are listed below.

Novell Support Connection CD

1. Provides searchable infobases that contain technical support information, patches and drivers, product documentation, and other resources.
2. Updated monthly.
3. Designed for anyone who needs information about networking.
4. Available by subscription as a single-user license or a site license.

If you are a CNE, you can subscribe to the Novell Support Connection CD for 40 percent less than the regular subscription price. Even if you have to pay the full subscription price, the money you save by not calling Novell Technical Services will soon pay for the subscription.

GETTING THE RESOURCES YOU NEED

Whether you are using a new Novell product, an updated version of an existing product, or a product that has been discontinued, the product is supported by the Novell Support Connection CD. "Anything that helps to support a network," Wade explains, "we put on the Novell Support Connection CD."

Each monthly installment of the Novell Support Connection CD actually consists of two CDs. The TIDs, FAQs, patches and drivers, and other resources on these CDs are organized into three infobases. When you run the Setup program, it creates an icon for each of the following infobases:

- Network Systems Support
- Groupware Systems Support
- Novell Support Connection User's Guide

The main page for each infobase is organized into four sections. (See Figure 1.)

- What's New
- Product Support

Novell Software Connection Library

1. Provides copies of more than 85 shipping products, early-access release technologies, and beta products from Novell.
2. Updated periodically, as warranted by new product and technology development.
3. Designed for Novell channel partners.
4. Available by subscription through Novell DeveloperNet. ☎

- Product Documentation
- Program Information

What's New

The What's New section ensures that you won't miss any resources that have been added to the Novell Support Connection CD. This section includes updated technical support information, updated patches and drivers, and the latest editions of *Novell Application Notes* and *Novell Developer Notes*.

For example, in Figure 1, the What's New section includes a Year 2000 compliance test, a tool that allows you to test a computer's BIOS and real-time clock for year 2000 compliance. The What's New section in Figure 1 also includes information about the new technical support forums on the Novell Support Connection web site.

In addition, the What's New section highlights new capabilities offered by the Novell Support Connection CD itself. For example, Novell recently added hypertext links to the Novell Support Connection CD. (See Figure 1.) The first time you click one of these links, you must specify the location of your web browser. Thereafter, you can access links directly from the Novell Support Connection CD.

Product Support

The Product Support section (where Novell Support Connection CD users

spend most of their time) features the following resources:

- Technical support information, such as TIDs, FAQs, and Novell Labs bulletins
- Files, such as patches and drivers
- Technical publications, such as *Novell Application Notes* (with back issues from 1990 through 1997) and *Novell Developer Notes* (with back issues from May 1996)
- Training tools, such as hands-on lab projects and instructional papers

Novell Technical Services produces 30 to 50 new TIDs every day, and these new TIDs are added to the Novell Support Connection CD every month. The FAQs are based on actual customer calls and on actual customer questions submitted through the Novell Support Connection web site. Novell Labs bulletins announce third-party products that have been tested and approved to work with specific Novell products.

Novell Technical Services has organized the files on the Novell Support Connection CD into five categories, allowing you to access these files in the way that seems most logical to you:

- **Top 20 Novell Files.** This category includes the files most requested by users since the previous installment of the Novell Support Connection CD. These files may be old or new patches, drivers, or other downloadable files.
- **File Updates by Product.** This category contains all of the latest patches and drivers for any Novell product. You can easily download the patches and drivers available for the Novell products your company uses.
- **New or Updated Files by Product.** This category includes only files that have been introduced or updated since the previous version of the Novell Support Connection CD. You can keep the Novell products that your company uses up to date by simply downloading these files for every month.
- **Minimum Patch List.** This category contains the patches that Novell Technical Services recommends applying as a baseline. You should install at least these patches, so the Novell products that your company uses work as they were designed to work.
- **Third-Party Files.** This category contains patches that provide solutions

developed by third-party companies to simplify or automate various functions of Novell products.

As you can see, many of these categories allow you to access the same resources, so you can locate most resources in several ways.

Product Documentation

The Product Documentation section contains a comprehensive electronic library, including the following:

- Complete manual sets
- Installation, administration, and user's guides
- Technical references
- Various technical publications and documents that provide information about using and managing Novell products

New manuals and documents are added to the Novell Support Connection CD as they become available.

Program Information

The Program Information section contains information about Novell technical support programs. For example, you can find out which technical support options are available for you, whether you are a Novell customer or partner.

ACCESSING UP-TO-DATE RESOURCES

As you know, technical support information is virtually useless unless it is up to date. The Novell Support Connection CD is updated every month, so the resources included with this CD are always current. (Only the Novell Support Connection web site can provide more up-to-date resources. The Novell Support Connection web site provides essentially the same resources that the Novell Support Connection CD provides, but the web site is updated daily.)

To ensure that technical support information is accurate as products are updated or discontinued, Novell support technicians are required to search the infobases for outdated information whenever they write a TID. If the Novell support technicians find a TID with outdated information, they mark that TID as obsolete and include the relevant information from the old TID with the TID they are writing. In addition, Novell Technical Services periodically reviews

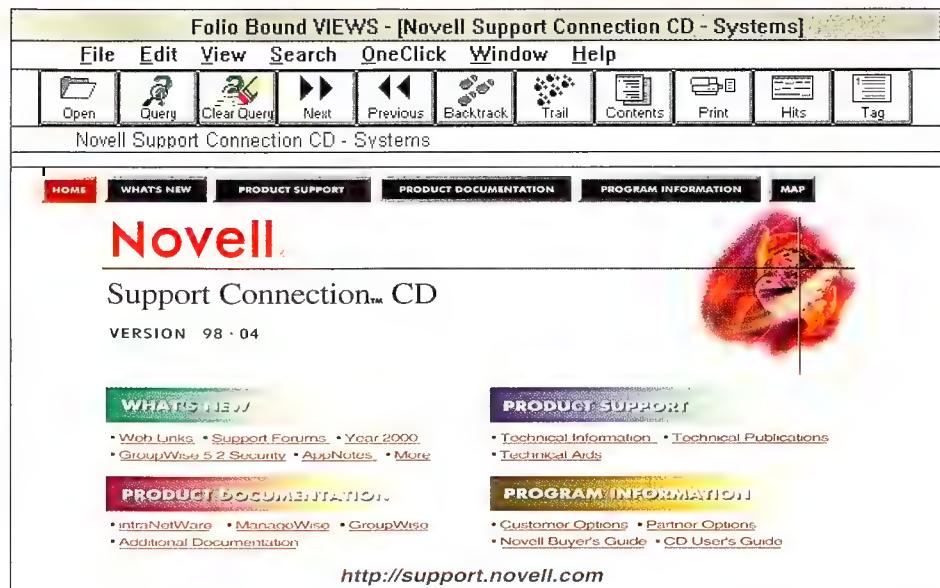


Figure 1. The Novell Support Connection CD includes three infobases, and each infobase has its own main page.

and corrects all of the TIDs for a particular product group.

Novell Technical Services also keeps the Novell Support Connection CD up to date by adding new patches and drivers to this CD every month. Novell continually develops patches and drivers, not only to address problems with Novell products but also to ensure that Novell products are integrated with third-party products.

USING THE NOVELL SUPPORT CONNECTION CD

You may think that because the Novell Support Connection CD is packed with resources, you may have trouble finding the exact resources you need. However, Novell Technical Services is always improving the Novell Support Connection CD, trying to simplify the process of accessing these resources.

"We look for better ways to get information about Novell products to our customers and partners," says David Telford of Novell's Electronic Support department. "The Novell Support Connection CD constantly grows and changes to meet the needs of these customers and partners. Our goal is to make it as easy as possible to use and manage Novell products."

Because Novell Technical Services works so hard to provide ease of use, you can quickly learn to use the Novell Support Connection CD. In fact, installing this CD takes less than five minutes. You

simply run the Setup program from disk 1 on your Windows workstation. (If you want to install the CD on a DOS or Macintosh workstation, you should read the README.NSC file or the README.MAC file on disk 1.)

The Novell Support Connection CD offers three installation options: Minimum, Standard, and Full. If you select the Minimum or Standard installation options, you download resources directly from the Novell Support Connection CD as needed.

If you select the Full installation option, you actually install the infobases on your workstation's hard drive. You need approximately 1 GB of hard drive space to install the infobases. If your company has a site license for the Novell Support Connection CD, you can install this CD as a volume on a NetWare server so everyone can access the infobases.

In most cases, you should select the Standard installation option. This installation option creates an NSC program group on your workstation, with icons for each infobase. In addition, the Standard installation option creates the necessary directories and then copies the program files to your workstation's hard drive, thus increasing the speed with which you can access the infobases.

After you install the Novell Support Connection CD, you might want to take a few minutes to become familiar with the *Novell Support Connection CD User's Guide*, which explains how to navigate

Technical Support Tools for the Information Age

The Novell Support Connection CD and the Novell Support Connection Worldwide Web site provide comprehensive information about Novell products in the fastest, easiest way possible. Both the CD and the web site contain the same resources, but the delivery mechanisms are different.

Novell Support Connection CD

1. Updated monthly.
2. Advanced search capabilities, fast download times, and in-line graphics provide convenient access to resources.
3. Complete portability enables you to access resources on site and when the network is down.
4. Cheaper and faster than telephone support.
5. Available to Master License Agreement (MLA) customers, Novell gold and platinum resellers, and original equipment manufacturers (OEMs) as part of their support agreements. Available by annual subscription to CNEs at a 40 percent discount. Other users pay full price for an annual subscription.

the infobases, search for resources, print documents, download files, and more.

As the Getting Around in the Novell Support Connection CD section in this user's guide explains, navigating the infobases is easy. Folio Views, the combination browser and search engine used to create the Novell Support Connection CD, includes several navigation tools that make it nearly impossible to get lost. (For more information about Folio Views, see "Folio Views: Making Resources Accessible.") These navigation tools include the following:

- Hypertext links
- A window that provides a table of contents for the section or, if you are performing a search, toggles between a list of hits and the resources themselves
- A navigation bar (see Figure 2), which can take you instantly to the main page, to any of the four main categories in each infobase, or to the map
- The map, which shows you the layout of the entire infobase

Novell Support Connection Web Site

1. Updated daily.
2. Advanced search capabilities allow you to access the resources you need quickly and easily.
3. Support incidents can be reported and tracked online.
4. Cheaper and faster than telephone support.
5. Available free over the Internet. 

The Novell Support Connection CD also includes a toolbar, which contains buttons that simplify the navigation process. For example, the toolbar contains the following buttons:

- The Query button allows you to quickly access the searching capabilities.
- The Backtrack button allows you to move backward sequentially through the pages you have accessed and the searches you have performed.
- The Trail button allows you to view a list of the pages you have accessed and the searches you have performed and to move directly to any previous location.
- The Hit button allows you to move directly to the hits that were returned from a search you performed.

You can customize the toolbar to include these buttons, or you can delete the buttons and choose from 70 other navigation tools. If you want to know more about navigating the infobases, you can read the Searching in the Novell Support

Connection CD section in the *Novell Support Connection User's Guide*. You may want to practice performing searches to ensure that you learn how to get the most out of the search capabilities available with Folio Views. (See "Folio Views: Making Resources Accessible.") After all, an infobase is only as useful as your ability to find the resources you need.

A CASE STUDY

Now that you know what is included on the Novell Support Connection CD, how would you use the CD to solve a particular problem? For example, a network administrator received several calls from users who could not access a directory on Novell Web Server. In checking out the problem, the network administrator discovered that she could access the directory and that other users could also access the directory.

The network administrator decided that she would probably find the information she needed by selecting the Product Support section in the Network Systems Support infobase. She then clicked the Query button in the toolbar and typed *web server directory access* as the query. After receiving 113 hits, the network administrator added the word *user* to the query. The number of hits was reduced to 70—still too many to review manually.

The network administrator knew that she needed to restrict the query but wasn't sure how to do it. She opened the *Folio User's Guide*, clicked the Query button, typed *query phrase*, and received 10 hits. (For more information about this user's guide, see "Folio Views: Making Resources Accessible.") Two of these hits were located under the Phrase Queries heading, where she quickly found information about how to structure a query.

The network administrator returned to the Product Support section on the Novell Support Connection CD, and since most of the hits to the previous query came from the Technical Information section, she decided to limit the search to this section. She selected the Technical Information section, clicked the Query button in the toolbar, and typed the following query, which included a phrase to restrict the query: *"web server" directory access*.

Although the *Folio User's Guide* had mentioned that phrase searches take longer than word searches, it wasn't long before this query returned 59 hits. To further restrict the query, the network adminis-

trator added the word *users* to the query, which then returned 31 hits. Although 31 hits was still too many to review manually, the network administrator decided that restricting the query any further might filter out important resources. She clicked the OK button and inspected the hits.

The first TID listed was "Web Server group level access control," which explained that granting rights by Group objects, rather than by User objects, would allow more users to access Novell Web Server. The network administrator had granted rights on a user-by-user basis. She followed the TID's step-by-step instructions on how to grant rights by Group objects, and all of the appropriate users could then access Novell Web Server.

The more you use the Novell Support Connection CD, the easier it is to find resources. In the case study, for example, the network administrator could have found what she needed more quickly if she specified the complete product name (Novell Web Server) in the query. In addition, she should have run the query in the TIDs area of the Product Support section, thereby searching a smaller portion of the infobase. As a result, the query would have taken less time and would have returned only 11 hits, including the relevant TID.

The network administrator could also have run the query in the FAQs area, which is even smaller than the Technical Information Document area. This query would have returned only two hits, the relevant TID and a FAQ entitled "How do I set up access control for more than 25 users to access a specific directory?"

In addition, the network administrator could have used the following query:

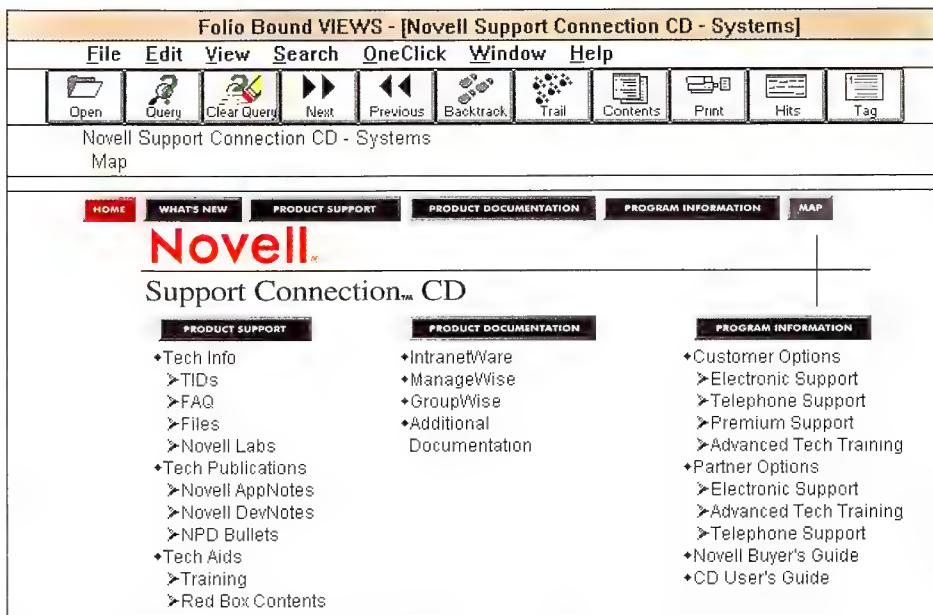


Figure 2. You can use navigation tools to browse for resources on the Novell Support Connection CD, or you can search for the resources you need.

[Group technical information documents] OR [Group faq] "netware web server" directory access. This query has the advantage of limiting the search to the two areas in which most of the hits were located. The query returned 13 hits, including the relevant TID and FAQ.

CONCLUSION

Electronic media are today's technical support mechanisms. "The only people still depending exclusively on telephone support are the ones who haven't gotten the message yet," says Wade. Telephone support is available if you can't solve a problem yourself. But to avoid the costs and delays you can encounter with telephone support, you should consider using

the Novell Support Connection CD or the Novell Support Connection web site to get comprehensive information about Novell products.

You can purchase an annual subscription to the Novell Support Connection CD in the form of a single-user license or a site license. Special discounts are available for CNEs and for additional CDs added to a base subscription. To subscribe to the Novell Support Connection CD, visit the Novell Support Connection web site (<http://support.novell.com>). You can also contact your local Novell authorized reseller, or you can call 1-800-377-4136 or 1-303-297-2725.

Niche Associates specializes in writing and editing technical documents. ☐

Folio Views: Making Resources Accessible

Folio Views is developed by Folio Corp. of Provo, Utah. According to James Tolbert, Novell's CD-ROM products production lead, Novell chose Folio Views as the browser and search engine for the Novell Support Connection CD for the following reasons:

- Folio Views offers advanced search capabilities.
- Folio Views can build an index of the entire Novell Support Connection CD text (a critical function considering the thousands of pages of text that are included on the CD).
- Folio Views offers data compression capabilities.

Folio Views allows you to perform high-speed searches, which you can refine by specifying the groups, records, fields, or levels

that you want Folio Views to search. You can also structure a query with phrase searches, proximity searches, binary searches (using the binary operators "and" and "or" to restrict the query), and multiple operators (stringing together as many words and binary operators as necessary to find the resources you need). In this way, you can receive only accurate hits.

The *Novell Support Connection CD User's Guide* clearly explains how to perform searches. If you want more information, however, you can refer to the *Folio User's Guide*. (To access this user's guide, you select the Open option from the File pull-down menu and then select the BROWSE.NFO file for Windows or the DBROWSE.NFO file for DOS.)

For more information about Folio Views, you can visit Folio's World-Wide Web site (<http://www.folio.com>). You can also call 1-800-453-6546 or 1-801-229-6710. ☐

Ensuring That All Web Traffic Uses BorderManager Proxy Cache

Terry L. Jeffress

Novell's BorderManager includes a feature called *proxy cache*, which can significantly reduce the overall traffic on your company's Internet connection and speed up users' access to World-Wide Web documents. In addition, the BorderManager proxy cache enables you to create access controls that enforce your company's policies for using the Internet. For example, you could allow only certain users or groups of users to access the Internet, or you could limit users' Internet access to business hours. However, these access controls apply only to users whose workstations are configured to use the BorderManager IPX-IP gateway and to users whose web browsers are configured to use the BorderManager proxy cache.

If a user's workstation is TCP/IP enabled, the user can bypass the BorderManager proxy cache and its access controls. The user can configure his or her web browser to access the Internet directly (rather than through the BorderManager proxy cache). In this case, the web pages this user accesses bypass the BorderManager proxy cache and go directly to the user's workstation.

Later, when a web browser that is configured to use the BorderManager proxy cache requests the same web pages, the BorderManager server must request these pages from the Internet because the pages have not been cached. As a result, your company's Internet bandwidth is wasted because the same web pages must be downloaded multiple times.

But even worse than wasting Internet bandwidth, users who bypass the BorderManager proxy cache have unlimited access to the Internet because they bypass the access controls you have created. You can then no longer enforce your company's policies for using the Internet.

Fortunately, you can ensure that all web traffic is routed through the BorderManager proxy cache. To route web traffic through the BorderManager proxy cache, you block all web requests except those requests made from the BorderManager server's IP address. To block certain web requests, you perform three tasks:

- Enable packet filtering.
- Create a packet filter that blocks all web traffic from your company's Internet connection.
- Create an exception to the packet filter that allows only the BorderManager proxy cache to use your company's Internet connection.

This solution assumes that you have configured a server to connect your company's network to the Internet. (See Figure 1.) If you have configured a router to connect your company's network to the Internet, you can use the router's management software to create the same packet filters.

ENABLING PACKET FILTERING

To enable packet filtering, you complete the following steps:

1. At the console of the server that provides your company's Internet connection, enter the following command:

`LOAD INETCFG`
2. Select the Protocols option from the Internetworking Configuration menu, and then select the TCP/IP option from the Protocol Configuration menu. The TCP/IP Protocol Configuration menu appears.
3. Set the Filter Support option to Enabled, and press the Escape key.
4. When you are prompted to update the TCP/IP configuration, select Yes.
5. Press the Escape key twice, and then press the Enter key to close the Internetworking Configuration utility.

CREATING A PACKET FILTER TO BLOCK ALL WEB TRAFFIC

To create the packet filter to block all web traffic from your company's Internet connection, you complete the following steps:

1. At the console of the server that provides your company's Internet connection, enter the following command:

`LOAD FILTCFG`
2. Select the Configure TCP/IP Filters option from the Filter Configuration Available Options menu, and then select the Packet Forwarding Filters option from the TCP/IP menu. The Packet Forwarding Filters menu appears.
3. Set the Status option to Enabled, and then set the Action option to Deny Packets in Filter List.
4. Highlight the List of Denied Packets option, and press the Enter key.

5. Press the Insert key to create a packet filter, and set the Destination Interface option to the interface that provides your company's Internet connection.
6. Set the Packet Type option to www-
http.
7. Press the Escape key and the Enter key to save the packet filter.

CREATING AN EXCEPTION TO THE PACKET FILTER

At this point, you have created the packet filter that blocks all web traffic from getting to the Internet. You should see a screen similar to the screen shown in Figure 2.

You must now create an exception to this packet filter that enables the BorderManager proxy cache to send web traffic to the Internet. To create an exception, you complete the following steps:

1. Press the Escape key to return to the Packet Forwarding Filters menu.
2. Highlight the List of Packets Always Permitted option, and press the Enter key.
3. Press the Insert key to create an exception, and set the Destination Interface option to the interface that provides your company's Internet connection.
4. Set the Source Address Type option to Host.
5. In the Source TCP/IP Address field, enter the TCP/IP address of the server that runs the BorderManager proxy cache.
6. Press the Escape key and the Enter key to save the exception.
7. Press the Escape key four times, and then press the Enter key to close the Filter Configuration utility.
8. At the server console, enter the following command to enable the packet filters:

REINITIALIZE SYSTEM

CONCLUSION

After you implement the packet filter, users who attempt to bypass the BorderManager proxy cache will not receive a response to their web requests because the packet filter blocks these requests. Eventually, users' web browsers will display an error message telling these users that the server on the Internet did not respond. To access web pages, users must

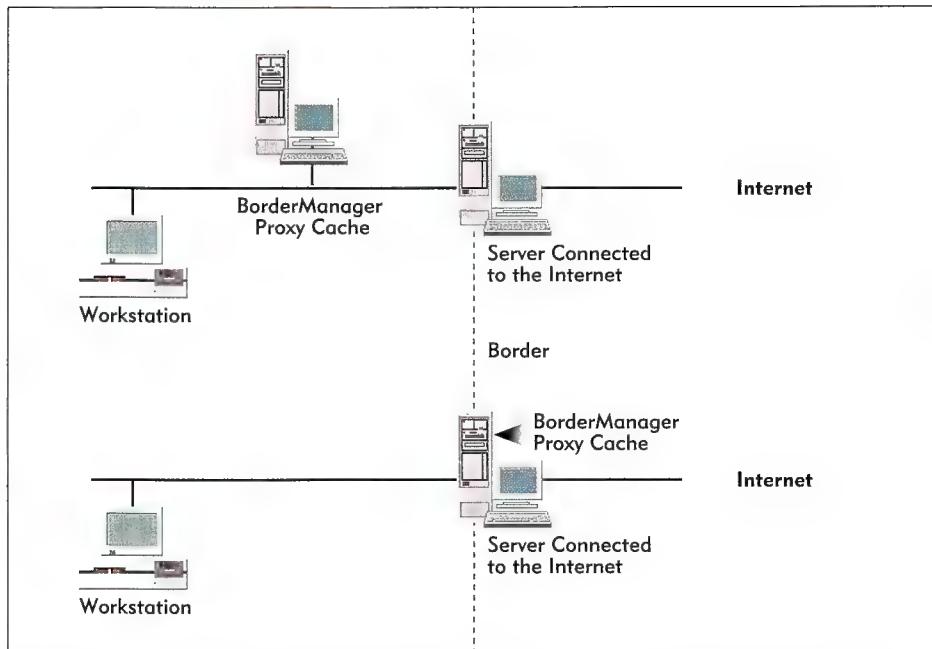


Figure 1. Whether the BorderManager proxy cache is on the border or behind the border, you can force users to access the Internet through the BorderManager proxy cache.

configure their web browsers to use the BorderManager proxy cache.

For more information about BorderManager, visit Novell's web site (<http://www.novell.com/bordermanager>). You can also read the following *NetWare Connection* articles:

- "Virtual Private Networks: Making a Public Network Private," *NetWare Connection*, Feb. 1998, pp. 6-21. (You can download this article from <http://www.novell.com/nwc/feb.98/vpn28>.)

- "BorderManager Caches in on the Web," *NetWare Connection*, Aug. 1997, pp. 22-31. (You can download this article from <http://www.novell.com/nwc/aug.97/bdrmgr87>.)
- "Novell's Border Services," *NetWare Connection*, May 1997, pp. 25-36. (You can download this article from <http://www.novell.com/nwc/may.97/border57>.)

Terry L. Jeffress works for Niche Associates, an agency that specializes in technical writing and editing. 

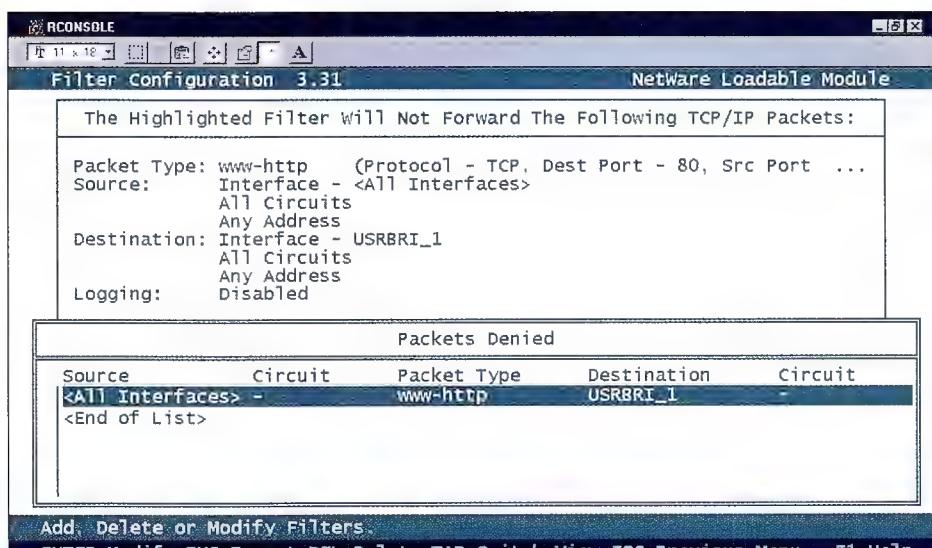


Figure 2. You first create a packet filter to block all web traffic, and you then create an exception to allow only BorderManager to send and receive web traffic.

NetWare 5 Beta 3

Novell has announced that NetWare 5 Beta 3 will be available later this month. Because NetWare 5 Beta 3 is being offered as part of Novell's open beta program, you can receive a copy even if you are not an official beta tester for Novell. You can purchase NetWare 5 Beta 3 for U.S. \$20 (to cover the costs of materials and shipping) by completing the online order form located at <http://www.novell.com/netware5/trial.html>.

For more information about NetWare 5 Beta 3, visit Novell's World-Wide Web site (<http://www.novell.com/netware5>). You can also call 1-800-NETWARE or 1-801-861-7000.

NetWare 5 CNE Certification

Novell Education has announced a new CNE certification for NetWare 5. To earn this certification, you must pass the following tests:

- Service and Support (test 50-626), which is available, or the updated version of Service and Support (test 60-635), which should be available in October 1998
- intraNetWare/NetWare 4.11 Design and Implementation (test 50-601) or Novell Directory Services (NDS) Design and Implementation (test 50-634), both of which are available
- NetWare 5 Administration (test 50-639), which should be available in August 1998
- NetWare 5 Advanced Administration (test 50-640), which should be available in August 1998
- GroupWise 5 Administration (test 50-618), Management Using ManageWise 2.1 (test 50-628), Securing Intranets with BorderManager (test 50-629), or intraNetWare: Integrating Windows NT (test 50-624), all of which are available

If you are already a CNE, you do not have to pass all of the tests listed above to certify as a NetWare 5 CNE. Instead, you must pass either NetWare 4.11 to NetWare 5 Update (test 50-638) or NetWare 5 Advanced Administration (test 50-640), both of which should be available in August 1998.

For more information about NetWare 5 CNE certification, visit Novell Education's web site (<http://education.novell.com>). You can also call 1-800-233-EDUC or 1-801-861-5508.

Novell SQL Integrator for NetWare

Novell has announced Novell SQL Integrator for NetWare, a database management solution. With Novell SQL Integrator for NetWare, you can access data that is stored in multiple databases distributed across a network, an intranet, or the Internet. Novell SQL Integrator for NetWare supports thousands of databases that are based on the SQL, Open Database Connectivity (ODBC), or Java Database Connectivity (JDBC) standards. For example, Novell SQL Integrator for NetWare supports Oracle8, Microsoft SQL Server, Informix, and Sybase.

In addition to providing access to data, Novell SQL Integrator for NetWare makes it easier for developers to write database applications. For example, Novell SQL Integrator for NetWare simplifies the process of cross-referencing data and eliminates the need to create hooks and joins between databases. Developers can even write database applications that communicate directly with the Novell SQL Integrator for NetWare application program interfaces (APIs).

Novell SQL Integrator for NetWare is scheduled for release later this month. At that time, you can purchase Novell SQL Integrator for NetWare from your local Novell authorized reseller. For more information about Novell SQL Integrator for NetWare, visit Novell's web site (<http://www.novell.com>). You can also call 1-800-NETWARE or 1-801-861-7000.

ConsoleOne

Novell has announced ConsoleOne, a Java-based server console that provides a framework for building intelligent network solutions based on open protocols and standards. Because you can snap any Java-based management tool into ConsoleOne, you can access multiple management tools from a single server console. In fact, Novell is in the process of porting all of its management tools, including the NetWare Administrator (NWADMIN) utility, to Java so you can access these tools through ConsoleOne. (See the related article on p. 6.)

Because ConsoleOne is fully integrated with NDS, you can grant network administrators rights to access different Java-based management tools. Then when network administrators log in to the network and try to access Java-based management tools, they can browse for and use only the tools to which they have rights.

Novell will ship ConsoleOne with NetWare 5, which is scheduled for release this summer. For more information about ConsoleOne, visit Novell's web site (http://www.novell.com/lead_stories/98/apr08/bridge.html). You can also call 1-800-NETWARE or 1-801-861-7000.

NDS for NT

Novell has reduced the price of NDS for NT. If you purchase NDS for NT before July 31, 1998, you will pay only U.S. \$16 per node. After July 31, 1998, you will pay U.S. \$26 per node.

NDS for NT, which now supports NetWare 5, eliminates many of the problems associated with managing Windows NT servers on an intraNetWare or NetWare network. NDS for NT also makes it easier to manage multiple Windows NT domains. With NDS for NT, you can create NDS objects for Windows NT domains, and you can manage these objects in the same way that you manage other NDS objects.

You can purchase NDS for NT from your local Novell authorized reseller. For more information about NDS for NT, visit Novell's web site (<http://www.novell.com/nds/nds4nt>). You can also call 1-800-NETWARE or 1-801-861-7000. ☐

INTERCONNECT

CONFERENCES

Making the NET work

InterConnect '98
Brought to you by:



NetWare Users
International

98

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Atlanta
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May 18-19

Rochester
May 21-22

Vancouver
May 25-26

Montreal
May 28-29

Toronto
June 1-2

Columbus
June 4-5

Detroit
June 9-10

Kansas City
June 15-16

Chicago
June 22-23

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June 25-26

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Plus, see the core messages
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Are You Certifiable?

NUI Can Help You Become Novell Certified

Brad Fischl

You may not have planned on becoming a network administrator. Maybe it happened by accident—technology, like disco music and other 1970 trends, may have crept up on you. Or maybe you became a network administrator by default—one day your company's mainframe was replaced by a PC, and you either had to learn how to use the PC or be left behind. On the other hand, you may have actually taken a computer class that helped you predict future technologies. Regardless of how you became a network administrator, you can prepare to meet the networking challenges of today and tomorrow by taking advantage of Novell's certification programs.

A TRADITION OF TRAINING

When the CNE program began in 1989, Novell was the first networking company to offer a certification program. Although other networking companies have since created their own certification programs, none of these programs have certified more users than Novell has. By participating in the CNE program, you can acquire the skills necessary to support a heterogeneous network, and you can focus on intraNetWare, NetWare 3, or GroupWise issues. (NetWare 5 training will also be available soon. For more information, see *Novell News* on p. 44.)

Due to the success of the CNE program, Novell launched two more certification programs in 1992: the Master CNE program and the Certified Novell Administrator (CNA) program. The Master CNE program allows you to expand your CNE certification by specializing in a particular aspect of networking, such as network management, network connectivity, or messaging. The CNA program, on the other hand, allows you to learn

basic network management skills. Because so many users need these skills to get started in the networking industry, the CNA program is Novell's fastest growing certification program.

Finally, Novell created the Certified Internet Professional program in 1996 to reflect the increasing importance of Internet and intranet technologies. By participating in the Certified Internet Professional program, you can acquire the skills necessary to plan, design, build, and manage your company's Internet or intranet site.

The number of users who participate in all of these certification programs speaks for itself: More than 400,000 users now hold some kind of certification from Novell, and an additional 225,000 users are enrolled in certification courses at Novell authorized education centers (NAECs) and Novell education academic partners (NEAPs) worldwide.

ONWARD AND UPWARD

Whether you want to further your networking education or simply stay up-to-date with the latest technologies, you should get certified as soon as possible. You can even turn to your local NetWare user group to make the certification process easier. (See "NetWare User Groups Help You Certify.")

For more information about Novell's certification programs, visit Novell Education's World-Wide Web site (<http://education.novell.com>). You can also call 1-800-233-EDUC or 1-801-861-5508.

Brad Fischl is the senior Novell account executive for New Horizons, the world's largest Novell training provider. You can reach Brad at bradley.fischl@internetMCI.com. ☎

NetWare User Groups Help You Certify

Many NetWare user groups are working hard to ensure that their members earn certification from Novell. For example, the Fairfield County, Connecticut NetWare User Group holds study sessions a couple of times each month to help members prepare for the CNE exams. These study sessions have paid off: Jay Ferron, the user group president, says that three members have become CNEs during the past six months.

The Atlanta, Georgia NetWare User Group also holds study sessions to help members prepare for the CNE exams. These study sessions are held once or twice a month, offering members a variety of resources. For example, members have access to a NetWare 4.11 server and a Windows 95 workstation that

they can use to practice network management tasks. CNEs often attend the study sessions to teach skills and give study tips.

In addition to holding study sessions, the Puget Sound, Washington NetWare User Group offers workshops that provide hands-on experience with Novell products. This user group also offers one-day FocusNet events: At FocusNet, instructors from a local Novell authorized education center (NAEC) train members on topics such as recovering from server crashes, setting up TCP/IP, and managing workstations.

NetWare user groups can get you on the right track if you are trying to become certified. To find the NetWare user group in your area, visit NetWare Users International's (NUI's) World-Wide Web site (<http://www.novell.com/nui/groups>). You can also call 1-800-228-4684 or 1-801-228-4500. ☎

Hit the Road

Matthew Jones

Some things never change: When you were in school, you probably couldn't help gazing out of the classroom window as the weather grew warmer, daydreaming about how you would spend your summer vacation. Even though you may not have the luxury of taking the entire summer off anymore, you can start planning to get away from the office for at least a few days. This article features World-Wide Web sites that you can use to make vacation plans, whether you want to travel by plane, train, or automobile. After you have made the necessary arrangements online, you can sit back and read all about this month's network resources and new products. You can also check out the new products I have found. (See "Product Snapshots" on p. 48.)

WORLD-WIDE WEB SITES

Expedia (<http://www.expedia.com>) is one of the most comprehensive travel-related web sites on the Internet. Because Expedia offers so many resources, you should visit Expedia's table of contents first. From the table of contents, you can access resources such as the Travel Agent, which allows you to make airline and hotel reservations, and the Travel Network, which allows you to shop for tours, cruises, and other vacation packages. You can also access Expedia Magazine, an online publication that features travel news, travel advice, and panoramic photo essays.

In addition, you can exchange travel information with other users by visiting Expedia's chat forums. You can even take advantage of links to the official web sites of more than 10,000 cities, from Abu Simbel, Egypt to Zurich, Switzerland.

If you can't find the information you need on Expedia, your best bet is Travelocity (<http://www.travelocity.com>), which rivals Expedia's vast range of resources. Travelocity specializes in helping you find the lowest airline fares. You can request the three lowest fares for the dates and destinations you specify, you can view a list of each day's lowest fares for a particular city, and you can take advantage of the latest special fares, such as American Airlines' BreakAAway fares. You can even sign up for Travelocity's Fare Watcher e-mail service, which sends you frequent fare updates for any five round-trip flights you choose.

Travelocity also specializes in helping you make travel arrangements for events such as COMDEX '98. In addition, you can make airline and hotel reservations, just as you can with Expedia, and you can view a Destination Guide that provides travel, business, and cultural information for hundreds of cities and countries throughout the world.

Although Travelocity's Destination Guide offers basic travel recommendations, Fodor's Travel Service (<http://www.fodors.com>) is the site to visit if you want in-depth travel recommendations. This site is the online counterpart to the Fodor's series of travel books, which is one of the most respected resources in the travel industry. Like the travel books, Fodor's Travel Service offers hotel and restaurant reviews, which you can search by using the Hotel Finder and the Restaurant Finder. You can also create a personal travel planner for the destination you choose, and you can read travel tips for this destination.

If you decide to travel by car, MapQuest (<http://www.mapquest.com>) can prevent you from having to purchase a map—or from having to stop at a gas station to ask for directions every time you get lost. MapQuest allows you to generate a detailed map of the area surrounding almost any address or intersection in the world. You can zoom in on different parts of the map, and you can configure this map to display icons that pinpoint banks, schools, and other landmarks. You can even view a list of directions that tell you exactly how to get from one location to another.

NETWORK RESOURCES

If you manage your company's intranet site or if you are planning to create an intranet site, you should visit The Complete Intranet Resource (<http://www.intrack.com/intranet>). The name is no exaggeration: At this site, you can find all of the information you need to run a useful and cost-effective intranet site. For example, you can read reviews of intranet applications and articles about intranet issues, such as how to develop an intranet publishing policy for your company.

You can also read intranet white papers, intranet case studies, and a list of frequently asked questions (FAQs) about intranets, as well as intranet-related press releases, product announcements, and industry news. You can even purchase intranet books online, and you can view a calendar of upcoming intranet conferences, training classes, and other events. In addition, you can download the Intranet Cost Calculator, a Microsoft Excel spreadsheet that helps you determine your company's intranet costs and return on investment.

If you still have intranet questions after accessing these resources, you can participate in IntraBoard, a real-time chat forum that allows you to discuss intranet issues with network administrators throughout the world. And you can subscribe to an intranet mailing list to receive e-mail messages that cover various intranet topics. You can also take advantage of

Product Snapshots

When I am looking for the latest computer games, I often find new and interesting products. Product Snapshots gives you a quick overview of the most useful products I have found during the last month. (Please note that these are first-look reviews; I have not conducted exhaustive testing.)

PC-DVD ENCORE DXR2

PC-DVD Encore Dxr2 from Creative Labs is a good, inexpensive solution if you want to upgrade a Windows 95 computer to read digital video disks (DVDs), which are taking the computer industry by storm. Now that DVD products are available at reasonable prices, more and more companies are releasing software, movies, and music on DVDs. A single DVD can store 4 GB to 17 GB of data—much more data than a single CD. In addition, many DVD products are compatible with CDs.

PC-DVD Encore Dxr2 includes everything you need to enable your computer for DVD technology:

- **A DVD-ROM Drive.** The DVD-ROM drive that comes with PC-DVD Encore Dxr2 is a second-generation drive that resolves many of the problems plaguing older DVD-ROM drives. For example, older DVD-ROM drives play DVDs only at single speed (equivalent to a 10x CD-ROM drive) and cannot read CD-Recordables (CD-Rs). The DVD-ROM drive that comes with PC-DVD Encore Dxr2, on the other hand, is a 2x drive (equivalent to a 20x CD-ROM drive) and is compatible with many types of CDs, including CD-ROMs, CD-Rs, and video CDs.
- **A DVD Video Board.** Because the DVD video board that comes with PC-DVD Encore Dxr2 supports both MPEG-1 and MPEG-2 video, you can play DVDs and video CDs on the DVD-ROM drive. You can view video on your monitor just as you can with other types of video boards, or you can view video on your television by attaching it to the DVD video board, which contains S-video and composite outputs.
- **A Windows-based DVD Player.** The Windows-based DVD player that comes with PC-DVD Encore Dxr2 allows you to play, rewind, forward, and pause video. In addition, this DVD player allows you to access all of the enhanced video and audio functions offered by DVD technology. For example, you can view video from different camera angles and select different playback resolutions, such as wide-screen or letterbox format. You can also listen to audio in different languages, with or without subtitles. You can even password-protect the DVD player so that children cannot play video without supervision.

You can purchase PC-DVD Encore Dxr2 through retail channels at the suggested retail price of U.S. \$299. For more information about PC-DVD Encore Dxr2, visit Creative Labs' World-Wide Web site (<http://www.soundblaster.com/mmuk/pcdvd>). You can also call 1-800-998-1000 or 1-405-742-6655.

WANDERLINK 3.0

WanderLink 3.0 from Funk Software Inc. is a complete remote access software solution for intraNetWare, NetWare 4, and NetWare 3. WanderLink 3.0, which runs on a NetWare or intraNetWare server that has one or more modems attached, allows

you to create a modem pool so that multiple users on your company's network can use these modems.

Users can dial in to the modem pool and connect to the network from any remote computer on which you have installed a modem and the dial-in client software that comes with WanderLink 3.0. (This client software supports Windows 95, Windows 3.x, and DOS.) These users can then access any network resource to which they have rights, just as if they were at a local workstation.

Users can also dial out of the modem pool to access the Internet and other online services from any local workstation on which you have installed the dial-out client software that comes with WanderLink 3.0. (This client software supports Windows 95 and Windows 3.x.) Because users can access the modem pool, you do not have to purchase and install a modem on each workstation to provide users with Internet access.

To prevent unauthorized users from accessing your company's network through the modem pool, you can use WanderLink 3.0 to implement one or more of the following security features:

- **Password Authentication.** If you implement this security feature, a user must enter a password to access the modem pool. You can configure WanderLink 3.0 to accept Novell Directory Services (NDS) passwords, or you can create a separate password database for WanderLink 3.0.
- **Restricted Dialback.** If you implement this security feature, a user who dials in to the modem pool is not granted access to the network immediately. Instead, when the user dials in to the modem pool, WanderLink 3.0 calls the user back at the telephone number assigned to the user's account. (You must create an account for each user who needs to dial in to the modem pool. When you create this account, you enter a telephone number at which WanderLink 3.0 can reach the user.)
- **Node ID.** If you implement this security feature, WanderLink 3.0 creates a unique node ID for each remote computer running the dial-in client software. Whenever a user tries to dial in to the modem pool from a remote computer with this client software, WanderLink 3.0 checks to see if the computer has the correct node ID. If the computer has no node ID or an incorrect node ID, WanderLink 3.0 denies the user access to the modem pool.

Because WanderLink 3.0 includes an advanced audit trail system, you can track all current connections and all attempted connections to determine whether unauthorized users have accessed or have tried to access your company's network through the modem pool. Once a user has successfully dialed in to the modem pool, you can use the domain filtering feature to ensure that the user cannot access restricted network resources. With this feature, you can make only particular network resources—such as servers, printers, and workstations—visible to the user.

In addition, WanderLink 3.0 includes a remote-control proxy program. With this program, you can control workstations on the network from a remote location.

You can purchase WanderLink 3.0 through retail channels beginning at the suggested retail price of U.S. \$495, and you can download a 30-day trial version from <http://www.funk.com/RegFiles/wltrial.html>. For more information about WanderLink 3.0, visit Funk Software's web site (<http://www.funk.com/product.html>). You can also call 1-800-828-4146 or 1-617-497-6339. ☎

links to intranet-related sites and to the home pages of intranet vendors.

STANDALONE GAME OF THE MONTH

Fallout from Interplay Productions is a post-apocalyptic adventure game that takes place in what remains of Southern California after a nuclear war. In this game, you assume the role of a man who was born and raised in Vault 13, a sealed fallout shelter.

As the game begins, Vault 13's water purification system has failed, thus cutting off the water supply. To prevent your neighbors and you from dying of thirst, you must find Vault 15 and get a replacement part for the water purification system. Since you have never left Vault 13, you must rely on directions to Vault 15 and on the game's online manual, written as a vault-dweller's survival guide.

Fallout allows you to customize many aspects of your character. You can configure levels of strength, charisma, and intelligence, which affect things such as how much armor you have and how much weight you can carry.

You can also select three primary skills from a list of 16 skills, including bartering, picking locks, and engaging in unarmed combat. In addition, you can select optional traits that influence the way your character acts. For example, if you select the kamikaze trait, your character continues to fight even when he is severely injured.

Fallout is available for DOS, Windows 95, and Macintosh. You can purchase Fallout through retail channels at the suggested retail price of U.S. \$54.95. For more information about Fallout, visit Interplay Productions' web site (<http://www.interplay.com/fallout>). You can also call 1-800-468-3775 or 1-714-553-6678.

NETWORK GAME OF THE MONTH

Star Wars Rebellion from LucasArts Entertainment is the first strategy game in the Star Wars series of games. Previous games in this series, such as Jedi Knight and Rebel Assault, are shoot-'em-up games that appeal strictly to action fans. Star Wars Rebellion, on the other hand, requires you to plan and implement a battle strategy as the Alliance challenges the Empire for control of up to 200 planetary systems in the Star Wars galaxy.

You can choose to make strategic decisions for the Alliance or for the Empire. If you fight on the side of the Alliance, you must guide your fleets to conquer the Imperial capital and to capture the planetary systems in which Emperor Palpatine and Darth Vader reside. If you fight on the side of the Empire, you must guide your fleets to destroy the Alliance headquarters and to capture the planetary systems in which Luke Skywalker and Mon Mothma reside. To accomplish these goals, you must successfully allocate resources, manufacture equipment, assign missions, and deploy fleets.

Although Star Wars Rebellion is a strategy game, you can also participate in combat if you crave a little action. When two fleets engage in battle over a planetary system, you can choose to join the battle, which allows you to issue orders, designate targets, and fight with your fleet.

If you are interested only in strategy, however, you can place the combat portion of the game on automatic mode. In this way, you can leave the actual fight-

ing to your fleet while you focus on making strategic decisions.

Star Wars Rebellion includes an electronic encyclopedia that provides useful information about all of the game's characters, vehicles, and planetary systems. For example, this encyclopedia lists the strengths and weaknesses of each character and vehicle and offers a profile of each planetary system.

You can play Star Wars Rebellion with one other person over a modem, a network, or an Internet connection. You can also play Star Wars Rebellion in standalone mode.

Star Wars Rebellion is available only for Windows 95. You can purchase Star Wars Rebellion through retail channels at the suggested retail price of U.S. \$42.95. For more information about Star Wars Rebellion, visit LucasArts Entertainment's web site (<http://www.lucasarts.com/static/rebellion/rebellion.htm>). You can also call 1-888-532-4263 or 1-415-507-4545.

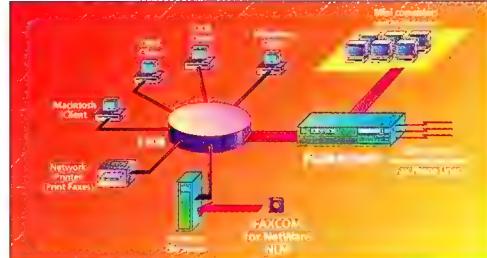
Matthew Jones is president of NetFIRE Inc., an Internet development company. You can reach him at matthew@netfire.com. ☀

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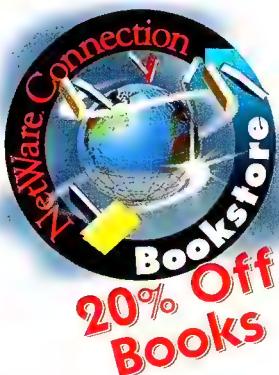
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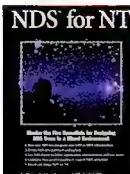
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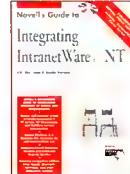
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NOVELL'S CNE PRODUCT LINK

Now available for NetWare Connection subscribers, NUI members, and CNAs.
Price: \$59.95

This set of CD-ROMs contains limited-user versions of Novell shipping, beta, and early-access release products such as NetWare 5. (CNEs must go to <http://cnenet.novell.com> for CNE discount.)

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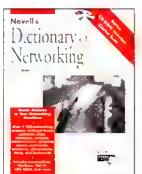
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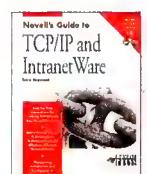
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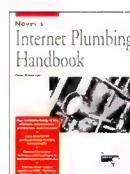
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Novell's Introduction to Networking
Cheryl C. Currid
328pp; ISBN: 45256
Retail Price: \$19.99
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Novell's Encyclopedia of Networking
Kevin Shafer
1,192pp; ISBN: 45116
Retail Price: \$69.99
Our Price: \$55.99

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Shawn B. Rogers
and Richard H. McTague
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Retail Price: \$24.99
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Kelley J.P. Lindberg
530pp; ISBN: 45175
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Novell's Four Principles of NDS Design
Jeffrey F. Hughes
and Blair W. Thomas
343pp; ISBN: 45221
Retail Price: \$39.99
Our Price: \$27.99

Novell's ManageWise Administrator's Handbook
Randi E. Constable
266pp; ISBN: 817X
Retail Price: \$29.99
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Novell's Guide to IntranetWare Networks
Jeffrey F. Hughes
and Blair W. Thomas
1,079pp; ISBN: 45167
Retail Price: \$59.99
Our Price: \$41.99

Novell's CNE Study Guide for IntranetWare/NetWare 4.11
David James Clarke, IV
1,570pp; ISBN: 45124
Retail Price: \$89.99
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Novell's CNE Study Guide for Core Technologies
David James Clarke, IV
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—	45337	Novell's CNE Study Set for IntranetWare/NetWare 4.11	10		\$148.99	\$119.19	
—	4537X	Novell's Internet Plumbing Handbook	2		\$34.99	\$27.99	
—	4540X	Novell's Guide to BorderManager	2		\$49.99	\$39.99	
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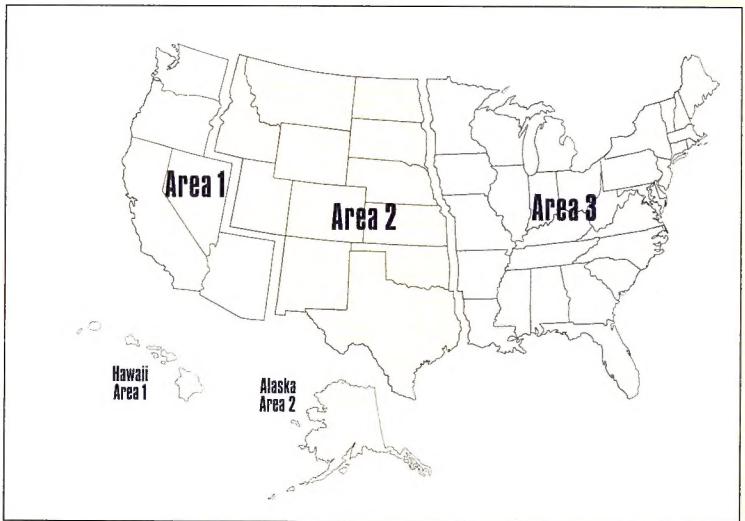
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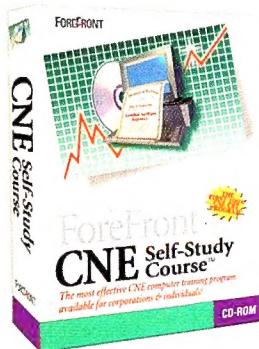
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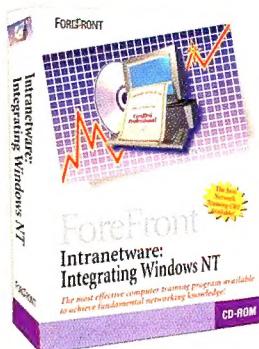
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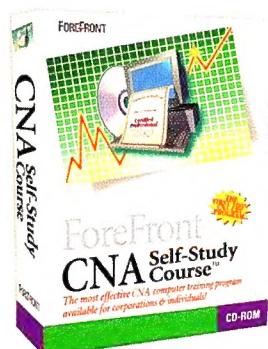
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